

A Hayden Publication

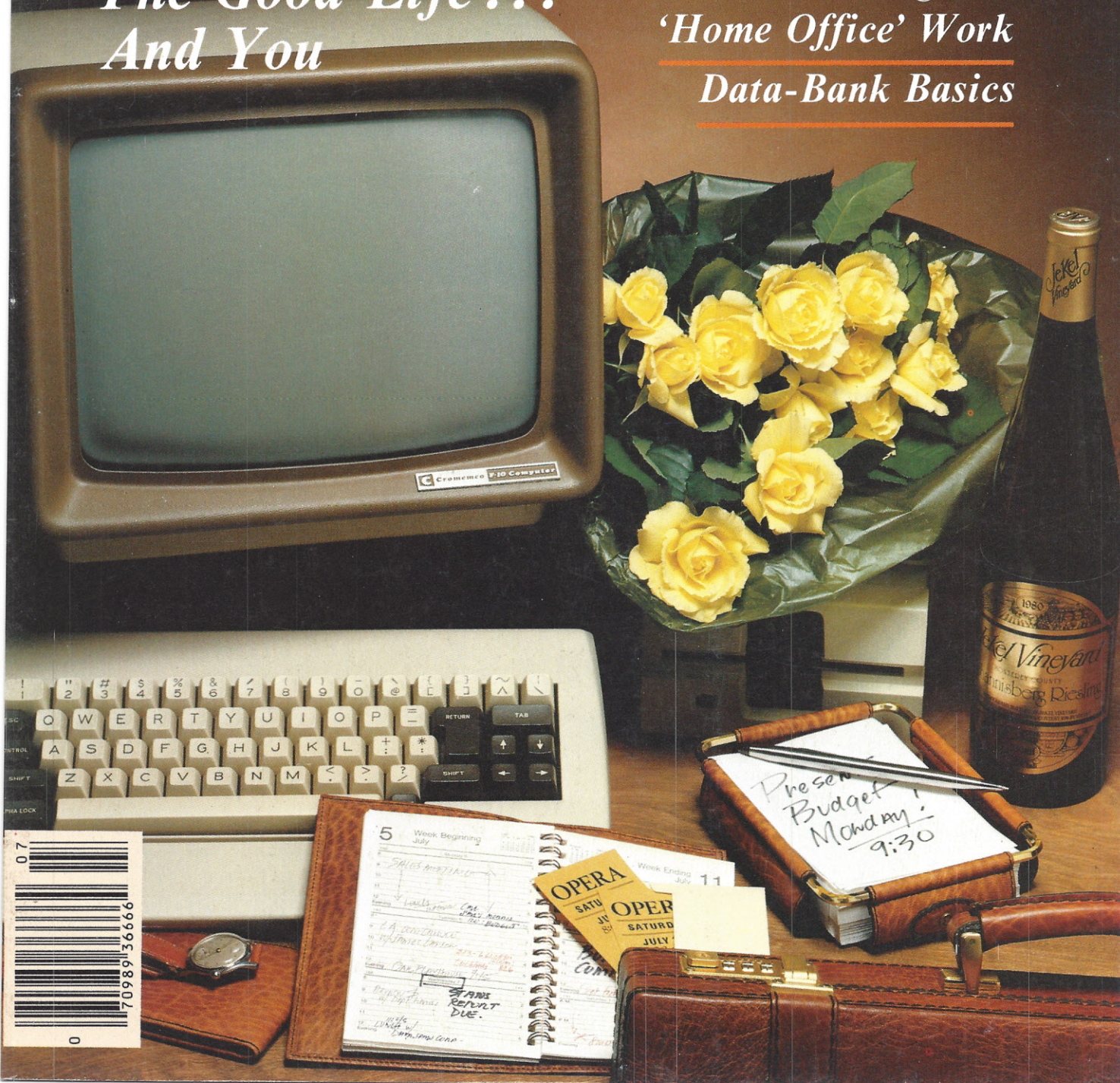
July 1982

\$2.00

PERSONAL COMPUTING

*Computers,
The Good Life...
And You*

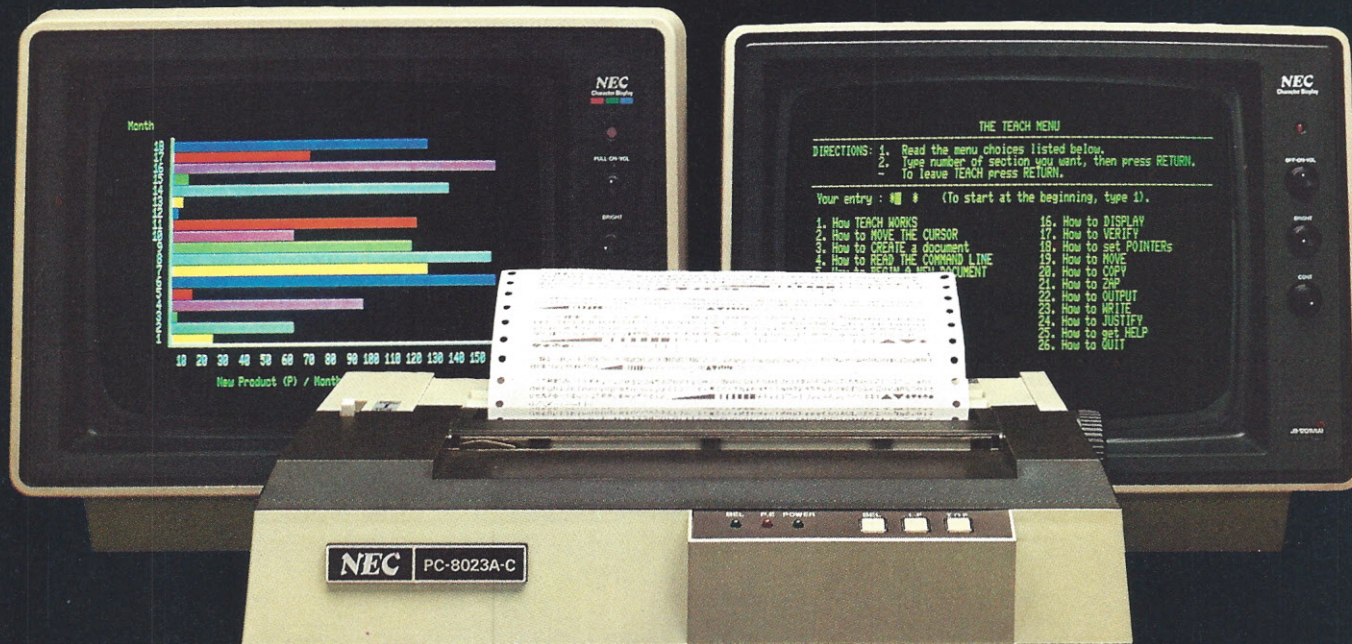
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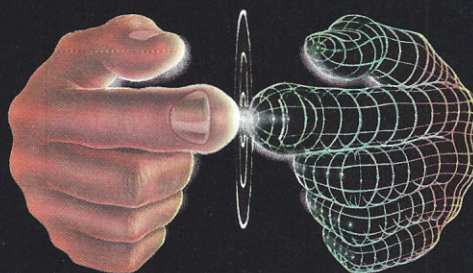


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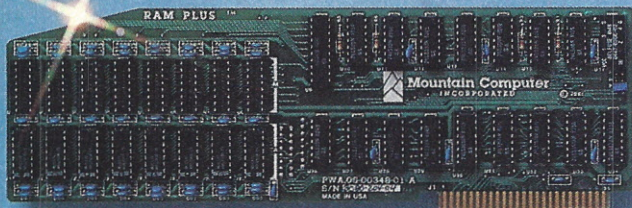
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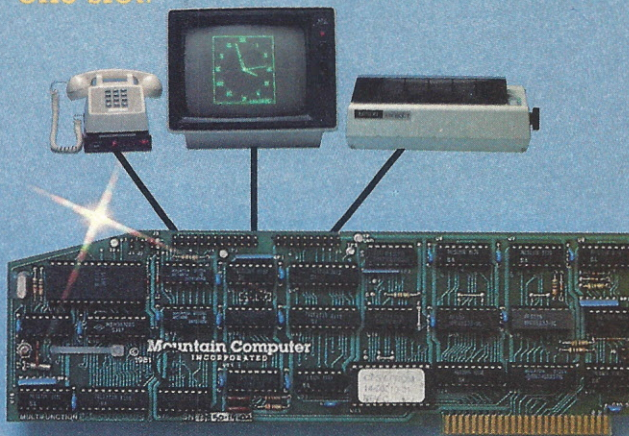
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Computer on cover courtesy of Cromemco.
Story begins on page 13.

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Self-improvement software merits your
attention—and perhaps purchase.

FEATURES

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48 PROFESSIONAL/MANAGERIAL CLIENTS, ACCOUNTANTS CUSTOMIZE NUMBER CRUNCHING

By Mark Fitzgerald

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By Margo Downing-Faircloth

Being able to compete financially while in the comfort of your own home is causing many people to work in home-based businesses.

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What do you need in a printer? Ease your buying decision by understanding the different types of printers available to you. (Accompanying buyers' guide begins on page 71.)

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Personal computing is changing lives both in radical ways and in more subtle, often overlooked ways. What benefits are you *really* deriving?

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106 ADVANCED A/D SOFTWARE EASES REAL-WORLD CHALLENGES

By T.M. VandenHeede

Analog-to-digital software is allowing computerists to expand the use of their computers into such realms as music, speech, and temperature monitoring of chickens and chocolates.

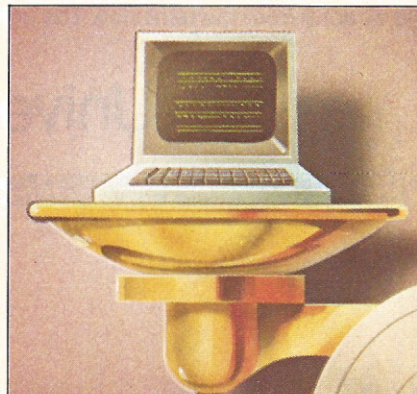
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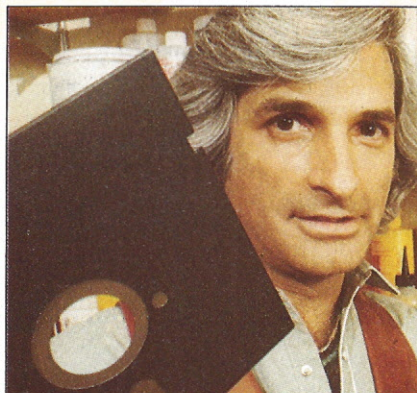
Word processing and data-base applications of personal computers are developing into potent political tools—and many politicians are grabbing these tools to grab votes.



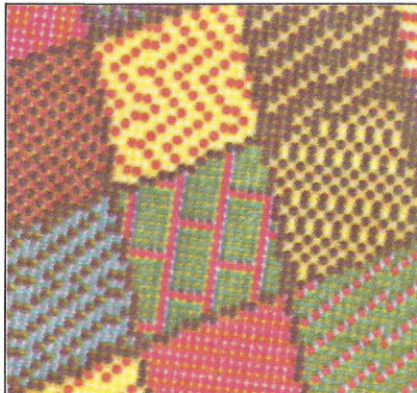
COVER



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CIRCLE 25

They Say That . . .

Our special report this month is a discussion of printers. I wonder how many of us have ever considered the myths of a product type like printers.

Almost everything has myths associated with it. This is particularly true in a relatively new field like personal computing. Someone says something is true, and since he's the "expert," what he says becomes true. But just as one man's meat is another man's poison, as the saying goes, one man's truth may be another man's myth.

Printers, an almost universal peripheral, are a good example. Almost anyone who needs a paper copy of his work needs a printer. Well, that's not really true. People could use a paper and pencil, but what's the point? They might as well not have a computer at all. But, for completeness, to satisfy the purists, almost everyone who wants a paper copy of his work needs a printer.

We also need printers to produce a copy of our work that is to be read by someone else, assuming that the someone else doesn't have a computer to access machine-readable information. This information is usually sent in a letter, which brings up the subject of letter-quality printers.

Why do we need letter-quality printers?

Some people say that we need letter-quality printers because we have always sent letters that are printed with fully formed characters, so of course we need letter-quality printers. Notice that this kind of reasoning simply boils down to the old "we've always done it that way, so we must continue to do it that way," argument. The fact is, though, that we haven't always done it that way. Before the typewriter was invented, business letters were written in long-

hand. They were written with feather quills, even before the steel quill was invented. I don't know that it's a fact, but I'll bet a conversation about the new-fangled typewriter could have gone something like this.

"I see you've got one of them new-fangled typewriters."

"Sure do. And by golly, we can get our letters out in half the time it used to take us. Saves me money."

"Well, I can see that. But I just don't think I could send a letter from my business that doesn't have hand-written characters on it. What would my correspondents think?"

Presumably, enough letter recipients thought printed characters were acceptable. Or if they didn't, their attitudes changed over time. Today, a hand-written business letter is rare.

Think about it for a minute. If you get a letter, do you care what the characters on it look like? Oh, sure, if they're very attractive, the letter might impress you. But does it make any intrinsic difference? Do you say, "Since this person used a fully formed character printer he's really on the ball," when you get a letter from him? Do you say, "Since this person used a dot-matrix printer for this letter, I know him to be of less than excellent character," when you receive his mail?

Of course not.

What you often care about is the readability of the letter. If you can read it easily, you don't have a problem. If you can't read the letter, you get annoyed. Almost every printer on the market today gives you characters that you can read, if you change the ribbon often enough.

I'm not trying to start a quarrel with those folks who manufacture letter-quality printers, or near letter-quality printers, or correspondence-quality printers. They're fulfilling a

need in the market—the need to produce documents that are "letter-quality," which means, essentially, that the characters look like they were printed with a typewriter. My problem is with those people who say that the need is real, as if that statement were an article of faith, unquestionable and inviolable.

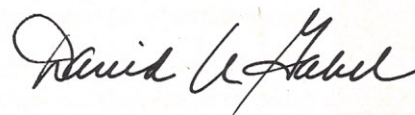
The point isn't that one machine is good and one isn't. The point is that you should get what's best for you. That rule holds whether you're looking for a computer, a printer, a disk or any other piece of hardware. This is especially true since this phenomenon called personal computing is really going to change things.

Just as the invention of the typewriter revolutionized the way office work was accomplished, so will personal computing change the way office work is done. Just as the invention of the low-cost automobile turned the world upside down, personal computing will effect profound societal changes. And that's not an article of faith. Anyone who observes what's happening can see that.

Because of these coming changes, we don't know what values society will put on things like typewriter-like letters in 10 years. We can guess that the value will be different than it is now.

So if you're going out to buy, do yourself a favor. Study carefully, and get the equipment that does the job you need. Don't be swayed because, "Well, of course you need this or that." Maybe you don't. Maybe your needs bear no real relationship to what "they" say.

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LETTERS

ONE READER INQUIRES . . .

In the article "A Programming Primer—Part III" in your May 1982 issue, figure 2 on page 120 was offered as "one solution to the problem"; however, no statement giving instructions for the calculation of the average grade ($A = T/N$) was included. At statement 160, which is PRINT "The Average Is";A;, A remains undefined in the program.

It was a smart trick to see if any of us were sleeping in class.

Also, thanks a million for the special report "High-End Systems: The Price of Power" in the same issue. I found the buyers' guide most useful. When others use it, I'm sure it will cut their looking time down by weeks, if the manufacturers respond in a timely manner to the reader's request for further information.

A.B. Rahman
MODESTO, CA

. . . AND ANOTHER REPLIES

In your article "A Programming Primer—Part III" in the May 1982 issue, the sample program on page 120 contains an error that would give an incorrect result in line 160. The article describes the need to divide (T)otal by (N)umber to obtain (A)verage. As currently set, (A) will always be zero. There should be a line 155 as follows:

155 LET A = T/N

I hope this information will help any readers who have not become familiar with BASIC. Keep up the good work with *Personal Computing*. I have a machine that uses the CP/M operating system, and routines that use this system are appreciated.

Gary W. Addison
MUNCIE, IN

"Hayden's *Personal Computing* magazine's accuracy policy: to make diligent efforts to insure the accuracy of editorial material. To publish prompt corrections whenever inaccuracies are brought to our attention. Corrections appear in 'Letters.' To encourage our readers as responsible members of our business community to report to us misleading or fraudulent advertising. To refuse any advertisement deemed to be misleading or fraudulent."

MORE ON PROGRAMMING

In the article "A Programming Primer—Part III" in the May 1982 issue, Mr. Leon Starr omitted the grade average in his program on page 120. And this appeared in the article that described the way you should "think through" the needed programming!

In my opinion, the simple program would be improved if line 160 were made into three lines so each result would be printed on a different line. Also, I believe you should have skipped a line between the printing of the grade average and the listing of the highest and lowest grade.

Marge Paulie
EUGENE, OR

ASK AND YOU SHALL RECEIVE

I recently bought an issue of your magazine, and was very impressed with its quality. I am considering a subscription.

In particular, your May 1982 issue was excellent, especially in the comparison of the various high-end personal computers that are available. (High-End Systems: The Price Of Power, page 52). A similar comparison on printers and sheet feeders would also be very helpful to prospective purchasers.

Nicholas Damer
EL GRANADA, CA

EDITOR'S NOTE: See our special report on printers in this issue.

ON A JOB WELL DONE

I have been working in the wonderful world of computers for the past 15 years and have enjoyed every minute of it. The only problem I have is the terminology between system programmers and the people who have little or no experience with computers.

That is why I wish to congratulate you on the materials you provide in *Personal Computing*. You help your readers understand computers without needing programming experience.

In addition, disappointment has passed through my phone wires many times because a businessman needs my services but we are not within reasonable traveling distance of each other. He is disappointed because I cannot supply him with a name of a personal-computer programmer in his area, and I am disappointed because I have to pass up some interesting projects.

Thus, I am starting to build a data base of personal-computer owners and

programmers, and I am publishing a newsletter that will help both the businessman and the programmer locate each other. Any interested parties can receive more information by sending me a business size SASE.

Pat Steele
STEELESOFT SYSTEMS
P.O. Box 224
GLENWOOD, IL 60425

ERGONOMICALLY SPEAKING, WHAT'S REALLY BEST?

Your answer to the question "What is ergonomics . . ." (Answers, May 1982) seems appropriate, although there are some inaccuracies that should be noted.

Green on white displays are probably as bad as black on white. So far, all available theoretical and practical research indicates that green and amber characters on a dark background are the most desirable. Green has the highest visibility coefficient in low illumination environments, while amber has the highest coefficient in high illumination areas. The dark background is necessary to reduce the amount of eye pupil adjustment that occurs when it moves across areas with contrast variations.

Whereas the "grapefruit halves" keyboard would probably be the optimal device for an abstract human, practical considerations would make it close to impossible to induce people to use it. Since ergonomics includes critical factors such as "easy-to-learn-and-use" computer systems, this alternative is ruled out.

Finally, hunt-and-peck typists care as much as anybody about keyboard layouts (eg. Selectric vs. Teletype), because they have to go through learning and using processes just like anybody else. Although it is true that their typing throughput relative to a professional typist is considerably lower, they still have a personal productivity factor, and thus it is important to minimize the amount of "grief" the machine gives them.

Let me also point out that you did not mention software ergonomics. This is currently the least understood yet most important human interface factor in a computer system. It is here where most, if not all, vendors fail to deliver designs that take into account the human mind as it exists today.

Richard Koffler
PUBLISHER
THE ERGONOMICS NEWSLETTER



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CIRCLE 3

On Memory Management And High Data Storage Capacity

In this new monthly column, "Answers," we will respond to your most frequently asked general questions about personal computing. Please send your questions to: Answers, Personal Computing, 50 Essex St., Rochelle Park, NJ 07662.

Q. What is the concept of bank select, and how does it differ from paging?

A. Bank select is a technique of memory management that makes the processor think it has more memory available than it can handle.

The bank-select technique allows different portions of the total memory (different banks) to be available at any one time. There is a bank-select bit in the address of a piece of data that tells the memory-management system which bank of memory the necessary data resides in. When the processor issues a fetch instruction for memory in a particular bank, that bank is selected, becomes active, and will provide the data requested until it is de-selected and another bank of memory is selected.

Paging is another matter altogether. Paging refers to the practice of having virtual "pages" of memory on a disk that can be brought into main memory under operating-system control. While it, too, is a way of fooling the computer into thinking it has more memory than it can handle, it requires no additional hardware. Well, that's a misleading statement. Obviously, it needs the disk and the memory to house the operating system that can handle the paging into and out of the virtual memory.

While both of these systems make the computer think there's more

memory available, their applicability is different. Bank select is usually employed on machines that have limited address space, like the 64k limited 8-bit personal computers. Bank select is commonly used to make these into 128k machines.

Virtual memory, with its paging, is commonly found on large mainframes that use long data words to get actual address space of 8 Mbytes, and virtual address space of much more than that.

Q. Why are so many computer manufacturers developing 16-bit computers all of a sudden?

A. There are several reasons. Only recently have 16-bit microprocessors become available for general use. Without such microprocessors, putting 16-bit computer power into the machines has made their cost prohibitive for personal-computing applications. Sixteen bits have been available for a long time in minicomputers, but minicomputers are much more expensive than personal computers. So 8 bits has been the limit for personal computers.

Now the situation is changing, and manufacturers are able to design 16-bit micros into their systems. This will benefit users in two ways. First, the 16-bit machines can manipulate twice the amount of data in the same time (roughly) that it took an 8-bit machine to do the same manipulation. That means that some functions that are too slow on an 8-bit machine, like sophisticated character generation, are a piece of cake for a 16-bit processor.

Next, microprocessors are limited in the amount of memory they can address by the amount of bits in an

address word. The more bits, the more memory. And the relationship isn't linear, it's geometric. So an 8-bit processor can only directly address 64 kbytes, while a 16-bit machine can directly access one Mbyte. That's a pretty significant gain.

Q. I see lots of references in your magazine and others to a Winchester disk. I know that's a hard disk, whatever that is. But what else is it?

A. Winchester, besides being the Apple capitol of Virginia, is the name of a particular class of disk drives. When IBM developed this class of disk drive several years ago, its internal code name for the project was Winchester. Drives like the ones IBM developed have been called Winchester or Winchester-type ever since.

Let's answer the implied question first. A hard disk is one that has a rigid platter on which the magnetic media—often iron oxide—is coated. A floppy disk, the other kind, has a flexible plastic substrate that bends. Thus the floppy designer.

The technology of disk drives involves a number of tradeoffs. The drives work by having a read/write head, similar to the head on a tape recorder, that senses the discontinuities in the magnetic field impressed on the iron oxide (or other) coating on the disk as that disk rotates past the head. It sounds simple enough. The problem comes in when designers try to get the maximum possible storage per square inch of disk space. To do that they have to make the magnetic domains (small areas of a particular direction of magnetic polarization) as small as

they possibly can. Not surprisingly, the smaller the domain, the weaker the magnetic force that's housed therein, so to speak, and the more sensitive must be the sensing apparatus.

There are a number of ways to make the sensing apparatus more sensitive, but the most popular (for a variety of reasons) involves getting the read/write head as close to the disk surface as possible. Floppy-disk drives achieve the ultimate in togetherness—the head and disk are in contact when the drive is in operation. That's OK for that media, since its flexibility means the head and the disk itself aren't damaged (too much) by the head-to-disk friction. Although contact might be good in the case of hard-disk systems, the rigidity of the disk surface would mean that the surface would wear very quickly, degrading the magnetic characteristics of the disk.

So the name of the game—since the closer the head gets to the disk surface the better the data resolution and the denser the data storage—is to make the distance from the head to the disk surface as small as possible.

Early hard-disk drives, and indeed some of those drives are still used today, depend on the mechanical stiffness of the read/write head-support arm to keep the head at the proper altitude above the disk surface. The problem with that approach is that as the distance above the surface decreases, the mechanical tolerances become more difficult, and hence more expensive, to maintain in production devices.

IBM found another solution in Winchester technology. The read-write head actually flies over the disk in this kind of drive. As the disk speeds up, friction with the air around the disk pulls the air along with the spinning surface. The head is mounted on a device that has wings, like the wings on an airplane, that lift the head off the disk surface and make it fly. The flight altitude

can be very carefully controlled, since it's a function of wing geometry and disk speed. Much closer distances are thus achieved.

But there's still a problem. With the head so close to the disk surface, a small piece of dust is much larger than the gap. Any dust getting into the head-disk gap could cause a disaster. So the disk has to operate inside a sealed chamber, in which the atmosphere is filtered to remove all particles large enough to cause any damage.

The older disks that used stiff mechanical arms to support the heads had actuators that retracted the heads from the disk surface so the disks could be removed for storage. (Remember, such disks are still made, so when we say "older disks" we really mean those made with older technology.) Such an actuator is expensive, and in a Winchester it's unnecessary, since the disk, in a sealed atmosphere, won't be removed for storage anyway. But there still has to be some way for the head to come to rest once the disk stops spinning. The solution was the incorporation of a lubricant in the oxide coating of the disk. When the disk slows, and the head loses aerodynamic lift, it then can come to rest on the disk surface without causing damage.

The combination of these characteristics—sealed chamber, flying heads, lubricated disk surface and filtered atmosphere—describe a Winchester disk.

Q. What is a double-density drive? For that matter, what's a double-sided drive?

A. A drive's data density is measured in bits per square inch. Well, that's true generally, but not specifically. Density is commonly measured in tracks-per-inch and bits-per-inch.

A data track is a circular area on the disk that looks similar to a toy train track. There are a number of these tracks arranged concentrically

around the center hub of the disk. (Of course, if you look at the disk, you won't see them. They're there because the drive circuitry makes the head move to areas of the disk that correspond to these concentric circles.) The number of tracks the disk can "write" per inch is called track density, and it's one measure of data density.


Bits-per-inch, the second density measure, is the number of bits the drive can write per linear inch in a given track.

The faster the data rate from the CPU to the drive, the higher the bits-per-inch figure will be. This data rate is controlled by the drive controller. That means you need a new controller if you are going to install a drive that writes at a higher bit-per-inch figure.

When you combine the density of the tracks with the density of the bits, you arrive at the data density. A double-density drive has twice the density of a "standard" drive. That translates to double the capacity, which is the payoff for the computer user.

A double-sided drive, as the name implies, is one in which there are two heads, and the heads can write on both sides of the disk, without the need to pull the disk out and turn it over. That means a lot more capacity—8-inch double-sided, double-density drives can pack 1.2 Mbytes onto one disk.

Double-sided drives have been around for several years, but it's only been in the recent past that they've been available in any great quantity. They were developed by IBM, as so many innovations in the computer field were. That firm used the drives, initially, for low-volume applications like initial operating system load and error logging.

Of course, other firms saw the utility of double-sided drives, which effectively double the capacity of a drive, and started to develop the devices for general-purpose use. 



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S	M	T	W	T	F	S
			14			17

A NEW PRICING PIONEER

How low-cost is a low-cost personal computer? Cromemco thinks it has the answer with the unveiling of its brand-new F-10 personal computer at the National Computer Conference in Houston. The machine tempts personal-computer buyers with a meager \$1800 price tag.

When Osborne Computer Corporation pioneered the low-price, full-featured portable computer market segment last year, the headlines said, "No competition for new computer. First complete system for under \$2000." What was true then is no longer true.

Osborne, based in low-rent Hayward, Calif., faces every kind of competition. Osborne set a tough standard for "full-featured" in this market segment. The box wasn't just a processor, screen and keyboard: The firm also threw in two 5¼-inch floppy disk drives (single-sided, single-density, total of 180 kbytes of storage), as well as software which users formerly had to buy separately, including the CP/M operating system, two languages, word processing and an electronic spreadsheet.

The firm also set a high portability standard: The unit fits under an airline seat and is allowed as carry-on baggage.

But, as is always the case, competitors saw niches. Dave Mandelkern, a research and development planner at Cromemco (Mt. View, Calif.), says his firm decided that what was selling the Osborne was not portability, but low price. "Portability is a secondary issue," he says.

So the Cromemco F10 personal computer, code-named "Falcon" during development, isn't as portable as the Osborne 1—it won't fit under an airline seat—but it's less expensive. A processor and monitor costs only \$995. A configuration comparable to the Osborne, with keyboard (\$195 to \$395), and a double-sided, double-density 5¼-inch floppy disk drive (390 kbytes of storage, \$595; 8-inch, \$1195) costs \$1780. Software provided will include the Cromemco CDOS CP/M-like operating system, at least one language, and one or two application packages.

By comparison, a similarly equipped Apple II would cost about \$2500.

When the Osborne 1 appeared, people asked how that company could make its computers so low-cost, when no one else seemed able to. The answer, according to the company, is simple—squeeze as much of the cost out as possible by paying attention to the details, like getting the absolute best price in component buys. As senior vice president and general manager Tom Davidson says, it's not magic: "No excess costs, no excess overhead, and no excess margins equals an unbeatable price."

Cromemco elected to follow a different path—component integration. In computer manufacturing, the more parts that are inserted into a printed-circuit card, the greater the manufacturing cost. So the company is

using a few custom Very Large Scale Integrated circuits (VLSI), and many of these, according to Mandelkern, the company designed itself.

The F10 is not only less expensive, Mandelkern notes, it is also more ergonomic. It has a full-size 12-inch display that can tilt and swivel, and it is easier to use.

"It is not a me-too product. It offers workstation/personal-computer performance at a very low price which we expect the professional to appreciate at home or at work." With the low price, Mandelkern expects to see some users with one machine at home and one at work.

The F10 is a significant departure from previous Cromemco products, including its high-end S-100-bus machines which operate with Cromix, its Unix-like operating system (aimed at scientific and technical users); and the systems 1D, 2D and 3D, which contain both a 68000 and a Z80 processor and are aimed at business users.

"We had the middle and the top. We needed a low-end machine for word processing and electronic mail, which can hang on our local area network, CNET," Mandelkern says, a role the F10 will fill.

BEYOND VISICALC

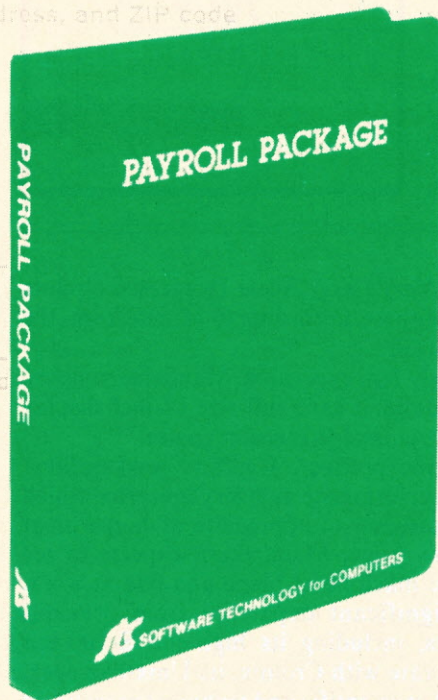
With the development of a new generation of personal computers (see *Personal Computing*, May 1982, page 20) it seems logical that a new generation of software should follow.

At least, that's what VisiCorp believes. The firm, which publishes VisiCalc, is debuting an advanced software system that it thinks will have the same impact that the original VisiCalc had—the proliferation of the personal computer in the business world. But while the original product made it easy for individuals to see a personal computer as essential in the office, VisiCalc Advanced Version, the company hopes, will make corporate officers feel the same way.

To that end, the firm has incorporated features in VisiCalc Advanced Version, that should endear the system to even the coldest-hearted corporate type. Chief among these is the templating capability. Using this capability, a corporate vice president of finance, say, could design the form on which department heads are to develop their individual department budgets. This would include similar names for particular line items, identical charge numbers and the like. The program would also step individual users through the template. When, for example, gross sales for a month is entered, the program, automatically will return the users to cost of sales for that month, without user prompting. And at the same time it's doing that, the program is also protecting its templates from accidental changes that could destroy their utility.

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Quarterly reports—
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Here is another savings of \$441

To reconcile and write W-2 forms—
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CIRCLE 8

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OUTLOOK

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VisiCorp sees this new program as a giant step forward in the utility of the personal computer in business settings. Because a manager can still have the utility of the personal computer for his own projects, but then use the same tool for projects that his corporation's top managers need. And it makes those personal computers even more useful than before to the corporation as a whole, allowing it to spread its top-management expertise to lower levels of management. According to Dan Fylstra, VisiCorp chairman, "It leverages the training and experience of managers in their area of expertise to develop tailored programs that are easy to use by less experienced personnel."

Because of its advanced features and support for complex functions, VisiCalc Advanced Version requires the large memory capability of the Apple III personal computer. Versions for other personal computers will be announced as they become available, the company says.

VisiCalc Advanced Version is expected during the third quarter of the year, and should cost \$400.

A COMPUTERIZED CAREER COUNSELOR

Like many college students facing today's fickle job market, Jenell Olson, as a sophomore at Illinois State University in 1978, couldn't settle on a major. So, in some desperation, she took a class called Career Planning to help her chart some direction. The course, she remembers, was far different than she expected. Instead of a large, crowded lecture hall with a blackboard full of graphs and statistics showing the most fashionable career paths, the course primarily consisted of going into a private room, sitting at a PDP-11 mainframe computer terminal for a few hours a week, and working with a program called System of Interactive Guidance and Information (SIGI).

When Olson was using SIGI, it was only available for use on a mainframe, but it became available for the TRS-80 Microcomputer Model II in the fall of 1981.

As she remembers it, the electronic mentor had a strong impact on the direction of her life. "I thought I wanted to go into psychology," she says, "but after I took the course I realized I wanted to go into public relations."

Illinois State University didn't have a public relations program, so Olson transferred to Southern Illinois University and entered the major there. Because the public-relations curriculum concentrated heavily on writing, she honed her skills and is presently the editor of the Dallas Apartment Association's monthly trade newspaper. "I don't know what I would've done without the computer and SIGI," she says. "I'm frightened to think about where I would be now if I hadn't used it."

Olson is not alone in touting the virtues of computer-assisted career planning. Colleges and universities are increasingly using personal computers to augment and complement their job placement and counseling.

SIGI, developed in 1976 by Educational Testing Services in Princeton, N.J., is not the only planning system placement offices use. Another program, Choices, was developed this past April by the CSG Corp. for use on the Apple II. And Discover II, offered for the first time this summer by the Discover Foundation in Towson, Md., is available for the Apple II, TRS-80 Model II and S-100-based systems. But all the systems have the same fundamental goals—to make students think about their career choices and to let them know what's available in the job market.

"These systems follow the same sequence of steps that vocational counselors use," says Fred Lopez, coordinator of the Center for Career Choice at North Texas University.

The SIGI program that North Texas is using, Lopez explains, contains five sections:

- Values—The student defines the five most important factors in a job.
- Locate—SIGI develops a career list based on the student's values.
- Compare—The student selects his top three choices from the career list and asks any five of 29 available questions about those occupations.
- Planning—For his top three career choices, SIGI provides the student with information about the actual steps required to get the job.
- Strategy—The student is given advice as to which of his three choices appears to best suit his life needs.

"The values section was the most helpful to me," Olson recalls. "It forced me to think about what was important to me and in what order."

In Values, the student plays a question-and-answer game in which he decides the most important job factors and puts the factors in order from most to least important.

Olson's values placed independence and variety ahead of salary, an explanation for the public relations result. "I never even thought about what was important to me until I took the course," she says. "And I was surprised that I rated those aspects ahead of salary, because I had never thought about it before."

For his career center, Lopez feels that the Compare part of the program has been invaluable. "Before we had SIGI, we asked the student to do extensive library research before choosing a career," he says. "Now all the information he needs is on the computer."

The Discover II program, on the other hand, uses a videodisk player for interactive video presentations of work tasks, work settings, work example, "What is the work setting of a biologist?" and the computer will instantly access the information from the videodisk player, and the machine will play it.

While most experts in career planning are not willing to do away with the intimacy that a guidance counselor can

OUTLOOK

bring to student's job decisions, many feel that the personal computer is becoming a necessary adjunct to the sagacious college advisor.

"It's difficult for a counselor to try to sort through 2200 occupations in the United States," says Dr. JoAnn Harris-Bowlsbey, director of the Discover Foundation, "but a computer could perform that task in seconds. Also, a computer will work as many hours per day as it has to. A counselor will work a 40-hour week. And at no level are there enough counselors for students so a computer helps alleviate the shortage."

And, like career planning offices, many placement offices are computerized. An example is the placement department for the School of Management at Boston University in Massachusetts.

"We've computerized everything but the flagpole," says Placement Director Bob Bruce. "For instance, we have a service called 'Write-Away,' which is open to all seniors and graduates who are exploring the job market.

"To use the system, the student submits a master cover letter and a list of names and addresses of businesses to contact. The office's Wang personal computer is then used to type the cover letter and change the names and addresses of each company. "A student can receive his cover letters and envelopes within 48 hours after submitting a proofread master cover letter," Bruce says. "The system costs \$5 for a start-up fee, and 50 cents per letter."

Bernard Peloquin, a finance and operations major at the university, has used the 'Write-Away' service and likes it. "It's well worth the \$35 I spent for 60 cover letters," he says. From those 60 letters, Peloquin received 42 responses. The positive responses have resulted in two interviews for Peloquin, and he feels confident one will result in a job. "I would definitely suggest using the system," says Peloquin, who started using it himself at the urging of one of the counselors in the placement office.

Tony Guerrero, a marketing major at BU, agrees. "I sent out 50 letters," he says. "I got 20 responses, and at least I have job contacts on file."

The personal computer is also branching into career placement for handicapped students at the Florida State University Career Center. Roy Bonnell, the systems coordinator at the center, and a staff of 12 created a job counseling system that has been operational for only the past 10 months. Using Apple IIs, the center can perform special services for the 800 handicapped students on campus.

For career planning, the handicapped student uses a version of SIGI adapted for the Apple machines, but it's a far different version than Jenell Olson encountered. At Florida State, with a Votrax Type 'N Talk unit installed, all information coming from the SIGI program is converted into speech. "It's the world's first talking SIGI station," Bonnell enthuses.

The system, developed by Computer Systems Resources in Gainesville, Fla., has a special keypad so a student with limited movement can still run the SIGI program. The handicapped student can control the program with only one finger, and the unit can be attached to the arm of a wheelchair, or other devices.

If a student is not quite ready for career planning, but is trying to home in and define his own interests, Bonnell developed the Interactive Testing System (ITS), which is essentially a personality test. To aid the handicapped, ITS incorporates interactive video, voice synthesis, voice recognition and card reader scoring. The unit will read questions to blind students and will accept voice input. It will also produce braille output or voice from the synthesis unit. The synthesized voice information can then be recorded onto audio tape using a special Voice Activation Switch (VAS) and a special tape recorder for the blind available from the American Printing House for the Blind.

At the beginning of ITS, the student views a computerized video presentation of a counselor, complete with color graphics, explaining the parameters and instructions for the test. After that, the student can use either the keyboard or the voice recognition unit to input his answers.

Barry McConnell, the programmer who assisted Bonnell, has put the placement office computer system together over a period of two years.

"I spent six months in the offices of counselors and clerks to find out what was being done," he says. "Then I put everything together the best way I could with the equipment we had."

Personal computers are still in the beginning stages in assisting students in making career choices. Career planning packages are still relatively rare, and typically cost about \$1200 for the first year and \$800 a year for the update fee.

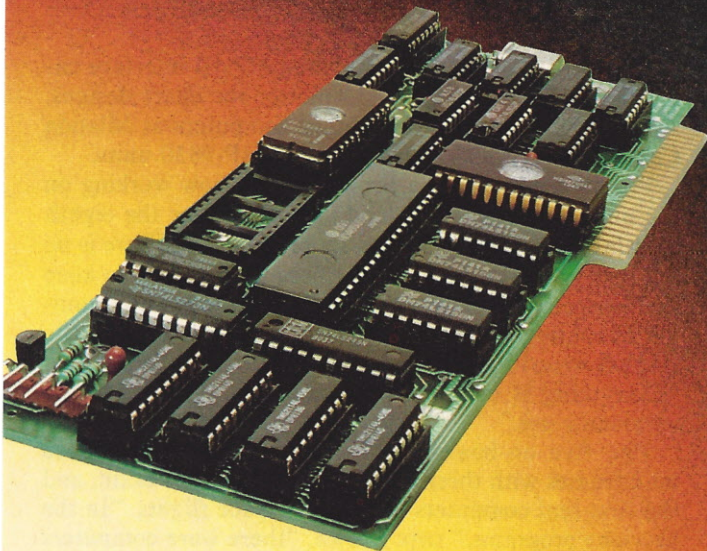
A COMPUTERIZED SPACE ODYSSEY

Space shuttle Columbia's next flight will include several firsts: the first trip with a four-man crew, the first landing on a relatively narrow concrete runway, and the first "operational flight," which will turn the spaceship into a huge delivery van hauling private television satellites, university experiments, and secret defense projects.

But some aspects of the flight won't change, says NASA project engineer Timothy Brown. "As soon as anything out of the ordinary happens on board the shuttle, you'll see a lot of people here at Mission Control in Houston scurrying for the aid of their desktop computers."

Personal computers will not only be on desktops in Houston and Cape Canaveral in Florida—they will also be slipped into the pockets of the astronauts' suits.

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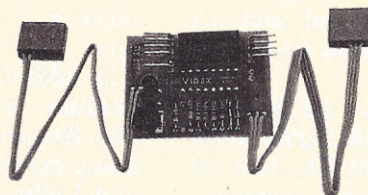
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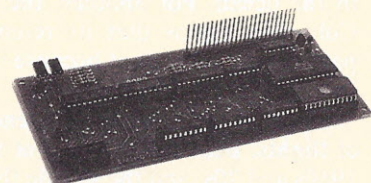
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OUTLOOK

During the flight, scheduled for launch on November 11, the four astronauts, Vance Brand, Robert Overmeyer, Joseph Allen and William Lenoir, will each be carrying a Hewlett-Packard HP-41C hand-held computer. The \$250 computers were bought over-the-counter from a Houston office-equipment store. They have been programmed to tell the crew where they are, how the shuttle craft is positioned in space, when and how long they will be out of touch with NASA ground communications, and what maneuvers they need to make the tricky re-entry into the earth's atmosphere.

If something went terribly wrong, Brown says, the pocket computers alone would provide enough information for the astronauts to land the shuttle safely.



The Columbia's pilot, C. Gordon Fullerton, uses his pocket personal computer aboard the shuttle.

By their very nature, space-shuttle flights require more exacting control than past manned space missions. For one thing, every landing must be virtually perfect because the craft lands like an airplane instead of splashing down in the ocean. For another, the glider-like design of the Columbia means that its re-entry angle and pitch are particularly important because it is powerless after entering the earth's atmosphere.

There is also another difference between the two types of flights: Between the time of the capsule flights of the 1960s and 70s, and the shuttle flights of the 80s, came the rapid development of NASA's use of personal computers. And in NASA's Space Transportation System, as the shuttle program is officially known, computers now occupy a leading role in planning and guiding the flights.

"I came here in 1977," says Brown, "and the first thing I put my hands on was a Hewlett-Packard HP-9820." All of the personal computers used in the space program are HPs, he adds. The most common system is the HP-9845

equipped with dual floppies, and an HP-IB interface cable that talks to an HP-9872 plotter for chart designs. Among the "several dozen" other computers at Mission Control are HP-9820, HP-9825 and HP-9830 units.

Project engineers like Brown, who is now working on the night launching and landing planned for the eighth shuttle flight, keep their own set of floppies. "There is no big master file or data control because we want to keep the computers user-oriented and available for any number of contingencies," says Brown, who feels that shuttle flights would be impossible without computers. "Everything is computerized, even the flight stick the astronauts use."

The five on-board IBM-designed general-purpose mainframes with three CRTs are the shuttle's brain, and the first real computers in manned space flights. "In the previous programs," says Brown, "there were computers on board, but they weren't exactly sophisticated."

Still, much of the mainframes' work, particularly during orbit and re-entry, is actually done on the ground by the Hewlett-Packards. Before the Columbia takes off on its fifth flight, the computers will have analyzed the design of equipment, the resistance to shock of various shuttle components, and the craft's expected, and unexpected, movements.

The robotic arm which the astronauts will use in satellite launchings and experiments was first manipulated on display terminals by NASA project engineers. Ironically, they lacked a simple piece of hardware many computer users would never be without. "The government won't buy joysticks, I guess because they are afraid we'll spend our time playing games," Brown jokes.

It is during the flight that the personal computers on the ground and in the hands of the astronauts become most important. For the astronauts, computer operations free them to perform tasks other than simply running the shuttle. The hand-held computers can be programmed to act as clocks, sounding an alarm when it is time for a chore. One of the programs on the HP-41C, for example, signals when the craft is over sites the astronauts are assigned to photograph for geologic or oceanographic data.

In addition to launching the two communications satellites—a Telesat for Canadian television and a Satellite Business Systems unit—the astronauts will be babysitting experiments that businesses and universities have paid \$5000 apiece to have flown in space. The experiments, sealed in nine cannisters, range from an attempt to manufacture tiny, identically sized latex particles that could be used to treat liver cancer, to a study of the effect of space on fruit fly growth.

Another program on the hand-held computer, which NASA calls "acquisition-of-signal/loss-of-signal," is the most convenient way of telling the shuttle crew the time,



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location and radio frequency of their next contact with one of 16 ground communication stations. Once contact is established, the HP-41Cs continuously display the number of minutes remaining before signal loss.

"If the crew is awakened in the middle of the night by an alarm—and that's happened on previous flights—they can tell at a glance how long it will be before they can discuss the problem with Mission Control," says Terry Hart, the NASA astronaut who was the primary author of the computers' software for the third shuttle flight.

"In the Gemini and Apollo flights, if you were off by 10 or 20 miles, it was an on-target landing," says NASA spokesman Stephen Nesbitt of the moon flights. "If the Columbia is off by 10 miles, it's a major disaster."

Hewlett-Packards, both earth-bound and in flight, are constantly crunching out real-time readings of the craft's "state vector," essentially its position relative to the sun. In addition, they are constantly monitoring Columbia's center of gravity as it shifts with fuel consumption. Both calculations are critical for successful re-entry, says Terry Stanford, the NASA project engineer who trained the four astronauts on the HP-41C.

"You want the ship to come into the atmosphere on a level course," Stanford says. "With the center of gravity calculation, the astronauts will know how much to burn from the fuel tanks, a process we call 'de-orbit burns.'"

Normally, that information is supplied by Mission Control personal computers and displayed on an on-board terminal that graphically represents altitude, range and pitch. "It shows a center line similar to the horizon display on a jet plane's instrument panel," project engineer Brown says. "They can watch themselves follow that center line and know whether or not they are on track."

But on previous flights, it has not always gone that routinely. "During the third flight (in March), we had several computers crunching out real-time analysis because the crew was forced to delay landing for a day due to the dust storms in New Mexico," Brown recalls. "That time delay changes the vector and calls for a new center of gravity calculation. During that flight we constantly went to our computers to re-design the re-entries at a number of different contingency sites, as well as at the New Mexico site. It gave us a good quick look at what we had to do."

The look has to be quick: Only once during each orbit does the shuttle have the opportunity to land at one of the six contingency locations.

Mission Control also relied on personal computers when it was discovered that several insulating tiles had torn loose during the lift-off of Columbia's maiden voyage last year. The lightweight, silicon tiles are designed to protect the shuttle from metal-melting temperatures that range up to 2700 degrees during re-entry.

"We sat down at our computers to run the re-entry and

check the probable heating levels at various points on the shuttle. That was the only way we could determine how to get it down without problems," Brown says.

Because of the extensive computer operation, project engineers sometimes portray the astronaut's hand-held computers as a kind of security blanket. "It's not really necessary, but it gives them a warm feeling," says computer instructor Stanford. Yet the astronauts could perform a successful re-entry with just the HP-41Cs if computer and radio communications were ever lost. "For their size, they have an awful lot of memory space," Stanford says, "and it would be plenty to get them down."

IT TAKES A THIEF

Computer crime doesn't necessarily mean fraud or embezzlement through access to computer software. There is a rising incidence of another area of computer crime, and one that promises to increase alarmingly as computers become more commonplace in homes and businesses. That area is the theft of computer hardware, which contributed to the total of over \$500 million worth of office equipment stolen last year.

An estimated 3,000,000 personal computers will be sold by the mid-1980s, up from the present 500,000, with only 1500 units sold just five years ago. Added to that figure will be more than 3 million remote terminals, plus countless other peripherals.

As with office thefts in general, computer thefts are committed by two basic groups of criminals: burglars and in-house or employee thieves. The loss of computer hardware always exceeds the actual replacement cost, based on lost production time, man hours, etc. For example, the value in the loss of a hard disk that contains vital company data is incalculable.

Unfortunately, the solution to this crime is as fleeting as a cure for the common cold. Property insurance on hardware is not a crime deterrent, but an after-the-fact measure. Serial and registration numbers on computer hardware may aid in the recovery and return of stolen equipment, but again, do nothing to prevent the initial theft.

Even though no one solution exists, a framework of crime-prevention techniques and common sense will eliminate a lot of thefts. Among the newest prevention methods is a security device called the Anchor Pad. Currently in use in university, corporate and government offices, the devices protect 20 machines for less than the price of replacing one stolen machine.

"During the past seven years some half billion dollars worth of IBM Selectric typewriters have been stolen," says Thomas J. Smith, president of Anchor Pad in Northern California. "The equipment theft racket will shift its demand toward computer hardware and will do so in a

(continued on page 24)

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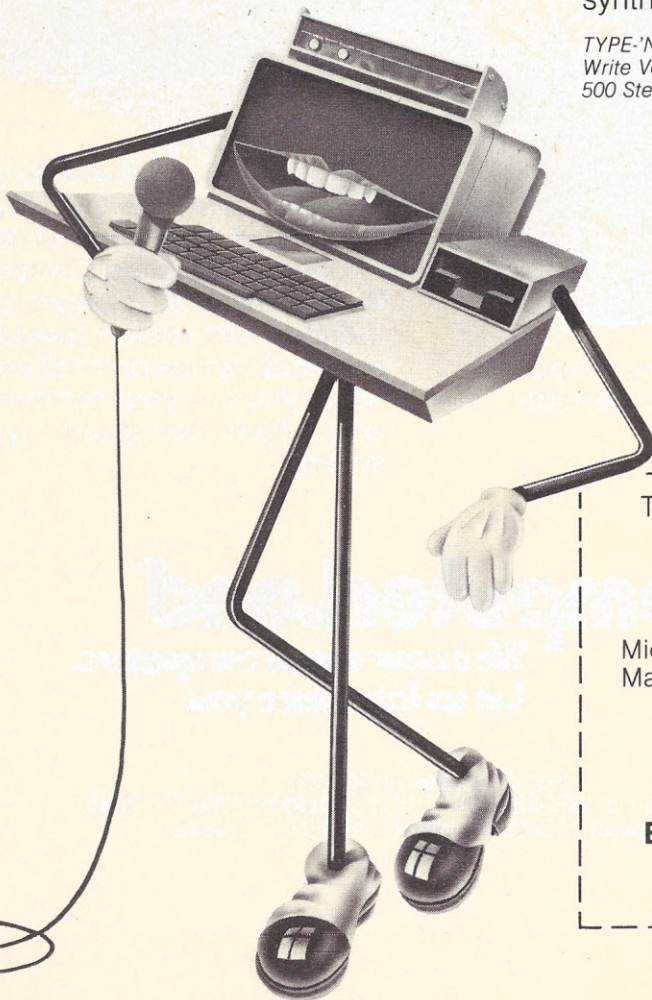
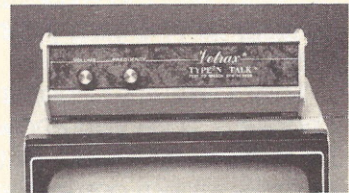
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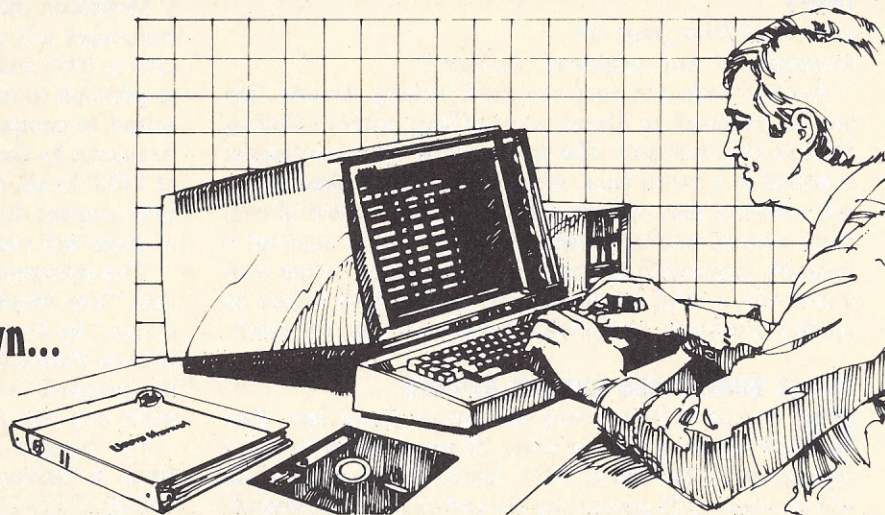
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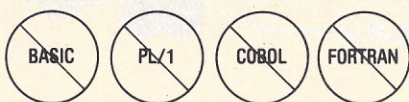
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OUTLOOK

THEFT

(continued from page 20)

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SMALL BUSINESSES ARE BIG BUYERS

Of the 2½ million small businesses doing less than \$10 million a year in sales, 20 percent had installed computers by the end of 1981. Such market penetration will increase to 25 percent by the end of this year, according to a new market report.

Moreover, market penetration of computers into small businesses will continue to surge, and will reach 44 percent in 1985 and 77 percent in 1990. That increase will be in addition to the growing number of businesses that are suited to computerization—namely three million establishments by the end of the decade, or 500,000 more than in 1980. In all, nearly four million computers will be sold to businesses during the 1980s, and more than 75 percent of these will cost less than \$10,000.

This information is provided by a 255-page study entitled "The Market for Computers Used In Small Businesses," by Frost & Sullivan Inc., a market-research firm in New York City. The market under review falls between the personal and large computers, with the break-off point at a cost level of \$100,000.

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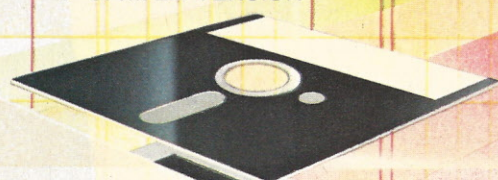
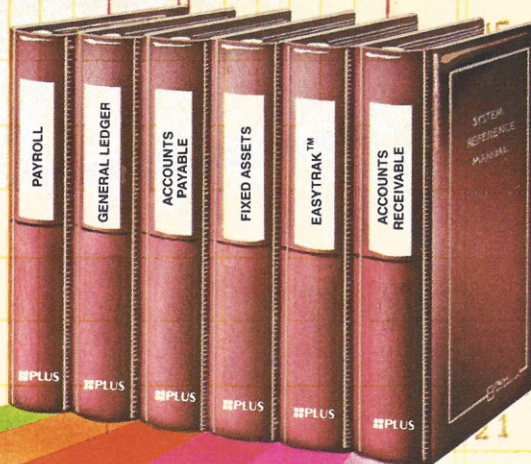
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The Well Tempered Risk

Nothing ventured, nothing gained is more than just an old truism. It's the backbone psychology of the computer user

by Evan Peelle

Can there really be anything new under the sun? It may seem somewhat paradoxical, but at the close of the 20th century, there still appears to be an ever-growing number of uncharted areas to explore. The enigma of our modern world is that the more we advance, the more of the unknown we discover.

The human mind has a unique curiosity and drive to grow. So we continue to create new frontiers to challenge ourselves and new ideas for meeting those challenges. In that sense high technology is the latest new frontier. And the personal computer is making that power available to anyone who takes advantage of the opportunity.

The adventurous souls who do are modern-day pathfinders—high-tech pioneers. They are the innovators—not only the inventors of computer technology, but also the early users and developers of new applications. At a wide variety of corporations, more and more people—faced with the importance of using personal-computing technology in their businesses—are involved in innovation. And like all their enterprising forerunners, these people are risk takers.

A unique service

An auto brokerage may seem like an odd place to begin a tour of corporate risk taking, but two years ago Sav-On Cars, in Southfield, Mich., poured a

significant capital investment into developing a specialized program for its personal computer. The custom software, it turns out, has paid off as an innovative way to provide a unique customer service.

Sav-On is in business not only to sell cars, but to arm customers with option and pricing information to increase their bargaining power. The company is owned and operated by Bill and Vivian Sallee. Auto sales and programming of the MA/COM-OSI (Bedford, Mass.) C-3C computer is handled by Andy Sallee, Bill's brother.

The economic climate aside, selling cars has become an increasingly complicated business. According to Bill Sallee, there are over 300 American car models, over 20,000 options, and over 40,000 possible prices—a massive amount of data to be handled. Moreover, the data must be constantly updated because manufacturers now introduce new cars at any point in time and change options and prices throughout the year.

In researching the market, Bill Sallee found that competitors offered long delays when responding to customer's requests for information, and often provided outdated or inaccurate data. In addition, they tended to give standard information to all customers without selectively addressing each person's particular needs. So customers received mountains of overwhelming and irrelevant information that they had to wade through to find what they wanted.

Sav-On decided to develop a more close-knit relationship with its cus-

tomers by offering immediate turnaround and accurate, up-to-the-minute data, individualized for each client—all at a nominal cost.

Personalized attention

But with these good intentions came a monumental data-management task. The Sallees were doing hand calculations, including double checking the figures and correcting errors. They then typed the final numbers and information on customer broadsheets. Until the computer. According to Vivian Sallee, "The computer has turned an hours-long chore into a five-minute operation—and the computer doesn't make mistakes. Someone can now phone in a request and receive a printout telling him exactly what he wants to know as fast as the mail will deliver it. That's important, because when somebody wants to buy a car, he wants to take immediate action, and a business doesn't want to lose him."

But the innovative aspect at Sav-On is not only the service, but the computer program on which it is based. It is a customized program designed specifically to meet Sav-On's data-management needs for quick input and retrieval, as well as the maintenance of a large, rapidly changing information base. And by developing this program, the small company took a significant risk.

The software took two years to create, and it ate up a hefty capital investment, which has not yet been turned into a profit. While Sav-On preferred not to quote exact figures,

Dr. Evan Peelle is an organizational psychologist/management consultant from Ann Arbor, Mich.

***"Risk takers live on
the leading edge
and sacrifice security
to face the unknown."***

Andy Sallee concedes that the cost of programming far surpassed the price of the computer. During the program's development period, business was intentionally slowed to ensure a satisfactory cashflow, and income was not rolling in. Sallee adds that though they are "extremely satisfied with what the computer can do," they "only hope that it will pay off in time."

What was Sav-On's motivation for taking such a financial gamble on its personal computer? The easy answer Bill Sallee gives is "public service and customer satisfaction." He says he believes that people ought to have access to information about wholesale as well as retail auto prices—in essence, they should know what the dealer knows—to have a fair chance in purchasing a car.

But there is much more to taking a risk in business than simple altruism. Vivian Sallee says that Bill has always been a risk taker who looks for new ventures—so there is the thrill of the hunt. And even beyond that, Andy Sallee suggests that Sav-On could have done something "more traditional and less risky, but to build-up a significant customer base we decided to try something totally new." And he adds, "Those of us who don't go sky diving need to find other ways to take risks in life."

Doctors in training

SmithKline & French, a health-care provider located in Philadelphia, and WICAT, a hardware and software development firm in Orem, Utah, are taking their leap by jumping into state-of-the-art computerized education technology. They have come up with a new process for teaching the critical art of making proper medical diagnoses.

A two-dimensional video-interactive system simulates a session between a doctor and patient. As described by Joanne Weiss, New York Area Director of WICAT's Training and Education Division, a

"patient" appears on the screen and tells the doctor/trainee his symptoms. The computer quizzes the doctor about which specific diagnosing steps he wants to take.

On video, the patient responds to the doctor's answers by physically moving. The doctor can order lab and other clinical tests and see the results—a full-blown X-ray would actually appear on screen. An interpretation key on the computer allows the trainee to consult with specialists and receive their opinions of the test results. After the diagnosis is completed, the doctor can treat the patient; for example, complicated surgery can even be performed. When the trainee indicates that he is through with the patient, the effect of his diagnosis and treatment is scored. Even these doctors have to live with the consequences of their decisions. As in real life, patients can be cured or killed.

According to WICAT's Weiss and Jim Snyder, director of SmithKline's International Division, both companies took risks in the development of the training program. Several years of time were invested, first in a proof-of-concept stage designed to determine the viability of the program. Whether the trainees who were going to use the system would find it interesting and beneficial had to be proven. Responses to the simulated "patient" had to be measured. More importantly, the utility of the interactive videodisk concept had to be tested since it was a new medium when the plan was inaugurated two years ago.

Darby Checketts, vice president of training and education at WICAT, says that SmithKline was "brave enough" to pioneer the use of videodisk technology for training purposes. And Weiss adds that SmithKline risked a significant capital investment on a test project, not knowing whether it would work. She indicated that SmithKline was willing to pay the price for "top-of-the-line" re-

search and equipment so the project would not be limited.

According to Weiss and Snyder, response to the project has been very good and "bookings are coming in from all over Europe." Snyder says that the risk was "worth it" and was in keeping with SmithKline's role as an innovator. He points out that the company was the first to use color television in medical education 20 years ago. And WICAT officials see the training program as being in the spirit of its charter, which seeks to develop high-tech media to improve the overall quality of education.

Interestingly, though, the Sav-On and SmithKline/WICAT ventures are vastly different in type, scope and resources behind them. But there is one basic similarity: Both risked substantial initial development investments of time and money for uncertain returns.

What's the payoff?

As these pioneers have demonstrated, innovation requires risk taking. Just as it has benefits, it also has its price and pitfalls. Change and uncertainty are a natural part of the process, as are mistakes and problems. Resources must be committed—especially at the front end—and may be spent for naught. If others are involved in making approval decisions or implementing the new idea, they may complicate matters by resisting. When others—the public, stockholders or owners, the boss, colleagues, co-workers or employees—are watching and reputations are on the line, the risk may seem even more extreme. Moreover, the risk is often our own self-esteem. And there is always the possibility that the payoff won't be big enough, or timely enough, to justify the risk.

For the manufacturers of new personal-computer technology, the primary risk is in investment time and capital. The gamble is greatest for smaller companies with limited resources, because those resources

"The intelligent circuitry provided by the computer expands our capacity to master our environment."

may not be adequate for seeing a project through to completion. And when the stake is gone, there is often nothing left but them holding the bag. In addition, the delays in income and tight cash flow that often plague small businesses cause many to give up. Larger companies share some of the problems with the smaller ones: They may end up with something that doesn't work or sell. While manufacturing failures may devastate the small companies, larger ones also suffer consequences such as loss of public trust or personnel transfers and firings.

Early use of a new product involves its own risks. Products are usually more costly when they are new on the market. In addition, products may be introduced before they are fully debugged. Only actual use can locate and resolve problems, so some difficulties are to be expected. But products that have undergone only limited testing may be rushed to the marketplace by developers trying to maintain a competitive edge. Since experience with a new product is more than likely lacking, there may be difficulties related to use rather than to the product itself. Since every aspect of a product's use may be "from scratch," difficulties can occur anywhere along the chain—for example, the user may have trouble locating sources for peripherals.

Place your bets

There are other good reasons for being cautious about taking risks in using new personal-computing technology. Because the field is so new and changing so fast, it is sometimes difficult to know what the good bets are. With the proliferation of innovations today, consumers may feel overloaded and will withdraw; some consumers have enough difficulty using existing technology, let alone taking on something new. And when the information necessary for decision making is lacking, reluctance may be natural.

To illustrate, when managers resist using a personal computer, they most often cite these reasons: They have not been able to get through the pages of ads pushing the machines and truly see the need for them, they are unable to use the keyboard and simply do not want to commit themselves to go through the training required, and they do not see sitting at a keyboard as part of their role in the corporation—the machine is unfamiliar, it might reduce their status, and using it requires too much change on their part.

The creative challenge

Some people are higher risk takers than others. High risk takers are compelled to seek the stimulation of change and challenge, and being unconventional and independent, they seek avenues for their creativity within their leadership inclinations. These people are not satisfied with the status quo. They prefer living on the leading edge, and risk security to face the unknown, try new things, and find better ways to contribute something of value. Of course, they may be motivated by pragmatic reasons, but nevertheless, they are ready to take chances to achieve new heights of excellence, efficiency, productivity and profitability.

An element of "fun" is often involved because risk takers tend to enjoy playing the game about as much as winning it. They persist and overcome obstacles to get what they want. Because these people are optimistic, positive thinkers, they expect to be successful and are not fearful of risks. In the final analysis, they tend to believe that there is more to lose by not taking risks. But they can also be impetuous, and may take foolish risks without thinking of the consequences.

Interestingly, research shows that risk takers are usually the most successful people. They tend to be effective on-the-job, leaders in their fields, and highest in management ranks. They also attain higher income and

profit levels while experiencing the least stress. As managers, these people tend to be innovative, and keep on the leading edge—ahead of competition. On the other hand, risk avoiders hold themselves and their organizations back, which may cause the firms to progressively fall behind their competitors; ironically, playing it too safe is dangerous in our rapidly changing world.

I only play to win

However, risk taking and innovation for their own sake are non-productive. Successful people play to win, and their risk taking is calculated, designed to reduce risk and turn the odds in their favor. They leave little to guess work or chance, which eliminates costly surprises, and at the same time, they remain flexible enough to respond to opportunity, and necessity. Information—not assumptions, opinions or wishful thinking—is the basis of their decision-making. Strategic planning is the key to their effectiveness.

Initially, people who take risks explore and gather information from a variety of sources—especially other people, which include customers, employees, competitors and innovators. This is market research or needs analysis, and it helps them determine what they want and what their constraints are. Next, they develop a "blueprint" to guide their efforts, and in this guide direction is spelled out including short- and long-range goals. A range of options for meeting goals is evaluated, and the steps, resource needs and timetables are outlined. This procedure is known as a feasibility check, and it ensures that adequate resources are on hand.

Progress is then evaluated periodically against predetermined criteria so tactics can be changed in time to salvage a project, or losses can be cut early. In these ways, information-based planning can reduce or eliminate much of the risk involved in innovation.

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Data Bases Fulfill Needs On Demand

Data bases exist to give you information you need at
the moment you need it. Easily

by David James

Consumers have come to expect the world from personal computers. After all, computers are supposed to do everything from balancing the family checkbook, to providing French lessons, to automatically turning off the lights.

And in a very real sense, the personal computer *can* bring the world into the home, or business—via remote data bases. These data bases, coming from a bewildering number of sources, permit the computer user to access information in incredible amounts—far beyond what an individual can generate alone. For the uninitiated, the idea of going on-line with some huge computer, in a location halfway across the country, can be a little intimidating. But the major general-purpose commercial data bases, such as The Source, CompuServe, and the Dow Jones News Retrieval Service, have made significant strides in the past year or so in making their data bases much easier to reach—and use.

A rainbow with two pots

Specifically, the communications software needed to get your computer on-line has been greatly simplified, and is relatively inexpensive. While horror stories abound of the early years of data-base access, the rule now seems to be one of user-friendliness. Data bases are about as threatening as a piece of Mom's apple pie.

David James is a free-lance business writer who comments on the personal-computing industry.

The data bases that exist can generally be classified into two categories. At one end of the spectrum are the general data bases, designed for multipurpose usage. Services such as The Source, CompuServe, and Dow Jones offer the user news and information; the ability to send messages via electronic mail to other computer users; electronic "bulletin boards" coalescing around a special interest, or just a means of saying "hello"; sports; weather; financial information, including stock quotes; and even the ability to buy or barter goods via computer. (More will be said about the offerings of these services later.)

At the other end are the specialized data bases serving very precisely defined vertical markets. These services include Mead Data Services—a textual retrieval service of legal case information; Information on Demand, a "research library" of information on a variety of topics; and the Dialog on-line service, sponsored by Lockheed Corp., which deals primarily with legal issues.

However, in some cases, these specialized data bases require specific types of hardware to be accessed. Mead Data, for example, is currently available only through Mead-supplied terminals, because of special hardware requirements. And, while most data bases—including such specialized data bases as the Smithsonian Institution's data base—can be accessed via personal computers, these data bases tend to be more expensive than the more general-purpose data bases. Therefore, they aren't for everyone.

If you are a doctor, a lawyer, or a professional with a very specific set of needs, however, the cost of a vertical data base, even one that may cost several dollars per minute to access, can easily be cost-justified. And, for the general computer public, the offerings of the major commercial data bases are quite broad, and can even find a home in the lives of professionals as well as home users.

One such individual whose data base experience straddles both the general-purpose data bases and the vertical markets is John Gonzalez, manager of banking information services for General Electric Information Services in Maryland. Gonzalez heads up a department that provides "the largest time-sharing service in the world for electronic funds transfer," he explains. "We provide the information and management by which approximately \$100 billion in funds is transferred each day."

And, Gonzalez states, his department needs information on demand, because "that's what we do ourselves. Data is our business." So, the department accesses some 1500 data bases in all. They range in size and scope from the Lexis legal and tax data base provided by Mead Data, to Lockheed's Dialog, to The Source.

Yes, The Source. Even in the midst of this high-powered data-base universe, Gonzalez and his staff use The Source for several purposes. "We use its legislative service to see what's going on in Congress," he states. "We scan that news twice a day. And we use its restaurant and travel services when we plan any business trips."

At the time, work on to develop data
bases to carry on the work of
information to the
personal-computer user.

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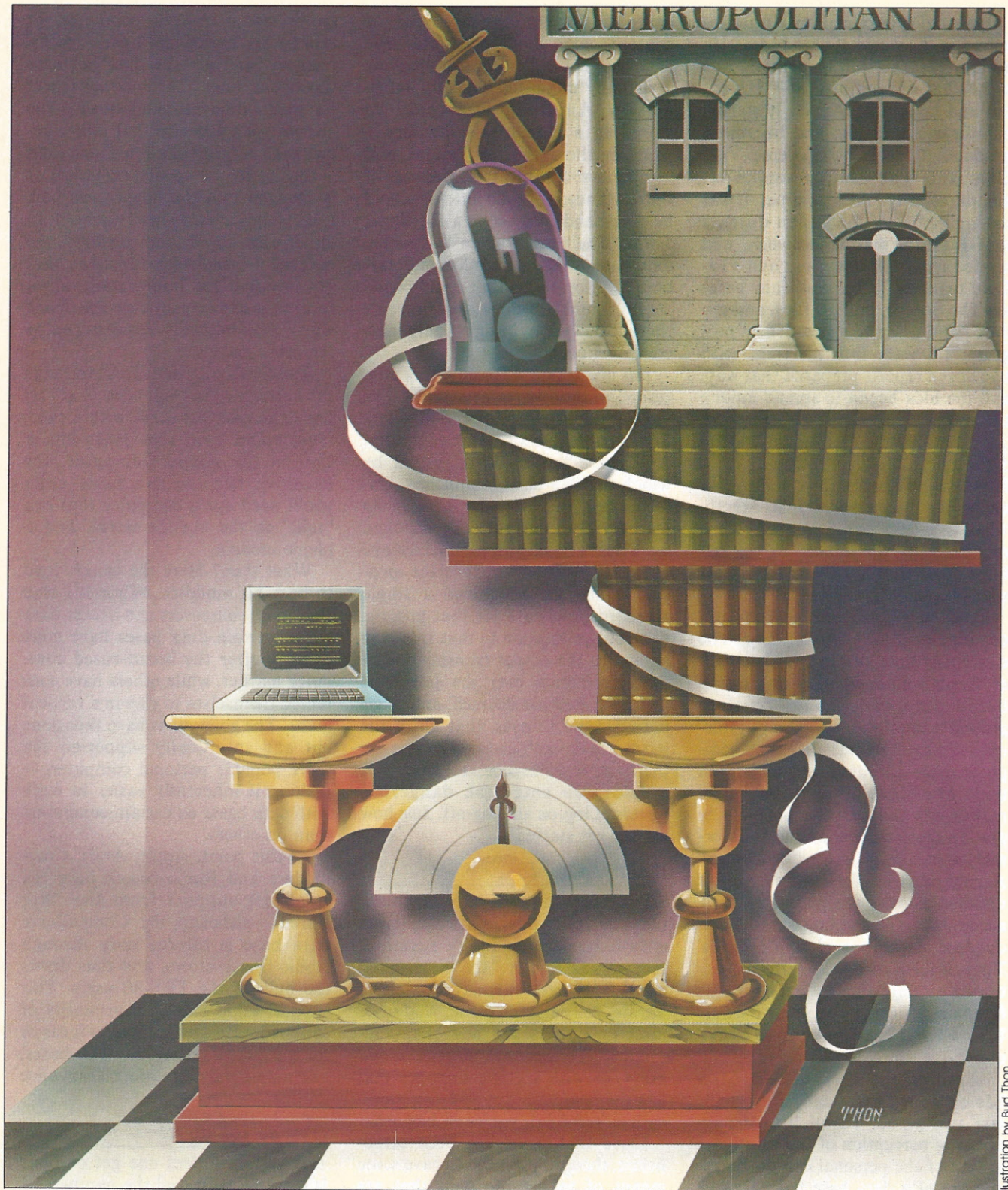


Illustration by Bud Thon

How did Gonzalez himself get involved in the world of data bases? He admits that his initial contact was somewhat serendipitous—“I went out and bought an Apple. It started out for me as a toy, and became a productivity tool. I discovered VisiCalc and The Source somewhat simultaneously. At the time, I was managing one of the largest districts in GE's information network, and started using the data base and VisiCalc together. I'd access data bases via The Source, pull off files, and update them using the spreadsheet program. I'd walk into meetings with two dozen reports prepared that way, and the idea began to spread among the staff.”

The nature of the beast

However, the story gets a little bit ahead of things here. Just exactly what is a data base? What are the requirements for a user to get on-line? And what are the most typical uses of a data base?

Data bases, in terms of the total computer industry, are not new. The concept of time-sharing, in the world of larger minicomputers and distributed data processing, revolves around a data base—a core of information that several different computer users can access at any given time. Much like a bank, that information sits and waits for someone to dial up the computer and talk. Information can be shared or exchanged. Accounting files, for example, can be updated as sales are posted, or bank accounts can be updated to reflect individual deposits and withdrawals. That information can also be accessed at any time by a company's financial officers, or by your friendly bank teller when you go in to cash a check.

However, the world of data bases has expanded drastically in just the last two years. Paralleling the increasing perception of the utilitarian nature of the personal computer, the concept of a data base has changed.

Instead of just one element of content—say, bank accounts—the data base could theoretically include a virtually unlimited range of information. Anything that could be stored in a computer's memory—from mathematical equations and computer programs, to summaries of the day's news, or even letters—could be stored and accessed as a data base. *Voila!* The push was on to develop data bases that carried this smorgasbord of information that could be accessed, quickly and at any time, by the information hungry personal-computer user.

But not so fast. Like anything else, computer data bases are coded. The user's computer has to be able to talk to the data base's central computer. And there has to be a system by which this can be accomplished. Unfortunately, as often happens in an industry that outgrows its britches, no single company—hardware manufacturer or data base provider—has yet developed a single standard procedure for that process. (The only exception to that rule is in regard to the actual transmission of the information over the telephone lines; Ma Bell has decreed, and it has indeed come to pass, that all of the hardware on both ends of the line use the same transmission standard.)

Thus, we enter the dangerous waters of log-on and log-off. Just how do you get started?

What you need

Simply put, virtually any computer that can act as a terminal can access a data base. In industry parlance, that means it can “act in terminal mode.” If you surpass that first hurdle, you're in the game. And since most computers are now manufactured with either that terminal capability, or with specific software that lets the computer act as a communications terminal, you're in business.

Once that point has been established, though, you need to have some means of taking the data that are

either stored in your computer, or stored in the data bases' main memory, and get the data out over the phone lines. The modem (short for modulation-demodulation) is the answer—it's a device that either accepts the handset of a telephone (and is thus called an acoustic coupler) or is plugged into the telephone's jack (and is thus a hard-wired modem). In either case, the modem performs the necessary translation functions that get the digitized information into a form that can be sent over the phone wires, and basically reassembled at the other end.

And that's it, primarily, in terms of the hardware that you need to get on line. The modems come with a communications card that plugs into a slot on the Apple Computer, for example; but the two basic units you'll need are a computer that can “talk” to the outside world, and a phone modem.

What then? Here the waters tend to be a bit muddier. While it's true that most computers can access data bases, certain data bases have gone directly after the broad-based computer market, while others have contented themselves to stay in a vertical niche. The generalists have thus gone out and specifically supported the more popular personal computers—making it inherently easier to work with data bases on certain computers than on others.

At this point, Apple, Atari, Commodore and Radio Shack have the strongest support from the “Big Three”—although the CompuServe data base is offered only through Radio Shack stores, and thus draws the bulk of the TRS-80 users. This support takes the form primarily of supplied software that makes it easier for the user to get into the data bases, and manipulate the information once on-line.

How do you do it?

And just how does one get on-line? It's simple. Just dial the number.

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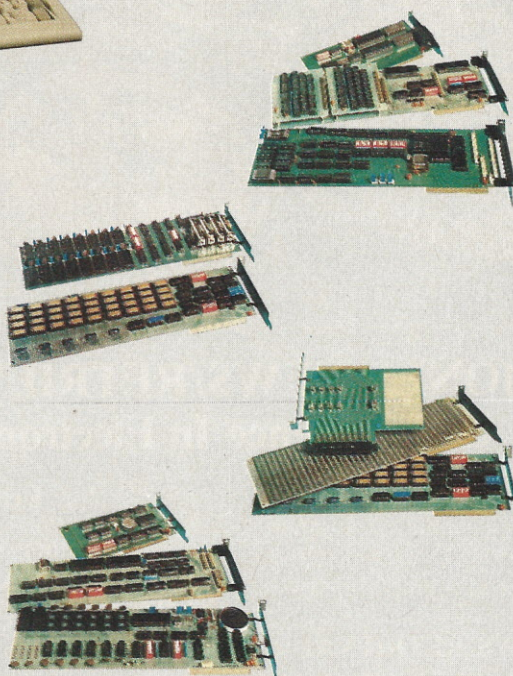
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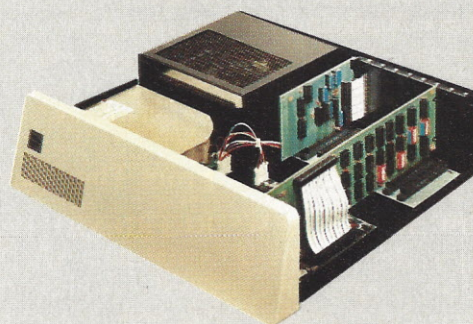
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"The log-on procedure used to be somewhat imposing for the uninitiated. But that's no longer a problem for the first-time user."

Actually, it's not quite that simple yet. The commercial data bases use either the Tymnet or Telenet time-sharing communications networks (it's a lot cheaper than setting up their own national communications networks), and the sign-on procedures (heretofore known as "log-on") can be mystifying to the uninitiated.

The log-on procedure goes like this:

- Dial the local access number;
- Hit "return" twice;
- Enter a pre-assigned two-digit i.d. code identifying the terminal, then "return";
- Enter an assigned computer system number, then hit "space";
- Enter a user-assigned password, anything from three to nine letters;
- "Return."

And you're on. But not on to the data you want . . . you've just logged on to the information service itself. From here, you confront the menu.

Your choice of . . .

For the uninitiated, the menu can be a lifesaver, especially when trying to remember just where a specific data base is located in the directory of one of the major information services. When a major service provides hundreds of different data bases or more, it's nice to have the menu for reference.

However, it does take time to go through the "decision-tree" process that narrows down your selection until you finally get the information you want. As a short-cut for the adventuresome or experienced, The Source, for example, offers single-key commands that can take you where you want to go—once you've been there a few times and remember all the signs.

The bottom line is that it can take up to 30 keystrokes to access a specific data base. For some, that's no problem, but for others, it can be an interminable wait.

Rob Lewis, an advertising executive in Los Angeles, hooked up to The

Source in early 1980. And he reports that the sign-on procedures could get a little hairy. "I experienced the growing pains that The Source went through," he recalls. "You could wait 10 minutes sometimes to get a response to a command or query." And, he adds, the log-on procedure could become somewhat imposing for the novice. "For me, it wasn't a problem, but I could see where it might be for the first-time computer user."

Mike Rawls, director of public relations for The Source, indicates that the access problems experienced by the data-base service have virtually disappeared since The Source's acquisition by *Reader's Digest* in 1981. "We now have six mainframes up and running," he explains. "That, plus an extensive power back-up system, ensures that we can provide good access time response for our customers."

And just what do people use a general-purpose data base for? What services are the most popular?

Says Rawls, "Communications services are still our most popular products. Users seem to prefer data bases that have strong interactive features. So our Chat, Electronic Mail, and Bulletin Board services remain extremely popular." But, he adds, The Source users are expanding their horizons as well. "One of our specialized data bases is Ed Net. It provides a legal text file and statistical compendium for educators and schools. The National School Public Relations Association, which is the national organization of school superintendents, maintains the data base, and it's used by most secondary schools throughout the country."

Other services that Rawls notes are gaining in popularity with The Source users are news and information-oriented services, such as the UPI newswire and stock-information services.

And speaking of stocks, the name Dow Jones and the stock market are virtually synonymous. However, as

Susan Perchonock, marketing coordinator for the Dow Jones News Retrieval Service, explains, the company's data-base offerings are broader than just stock ticks. "We currently offer 15 major data bases, and we're expanding all the time," she says. "Our most popular services are our current quotes and current news data bases, which are used both by private investors who wish to track their investments, and by businessmen who want to stay on top of financially related news and information."

Beyond the quotes and news reports, Dow Jones also offers transcripts of the *Wall Street Week* television program, presented on public television; disclosure information for investment purposes; historical stock quotes for long-term stock tracking and portfolio modeling; sports information; and weather.

As far as The Source is concerned, its offerings range from travel schedules, restaurant ratings, educational and instructional programs, a variety of computer games, and even an electronic shopping and bartering capability. In total, more than 1200 data bases are offered by The Source, giving the user an extremely wide range of services to choose from.

Paying the bill

But what does it cost? In the case of the Big Three commercial data-base providers, you'll have an up-front registration fee of about \$100. That will get you your password, and all the instruction manuals, catalogs and software that you need.

Also, in the case of Dow Jones, there are additional software programs that permit the user to interact in real-time with the information. The Apple Portfolio Evaluator, developed by Apple Computer specifically for Dow Jones, and The Dow Jones Market Analyzer, permit you to take stock quotes and feed them off-line into your own computer system. From there, your own stock

portfolio can be updated, and graphed, if you wish.

Both The Source and Dow Jones are also working on software concepts to make the time-consuming log-on process more straightforward—perhaps reducing the entire process to one keystroke.

But for now, when you log on to a data base such as The Source or Dow Jones, it's as if you're making a local call (which is, in effect, what you're doing when you tie-in to the Telenet or Tymnet phone lines). From there, the meter starts running, and you wind up paying by the minute when you're accessing a particular data base. Typical rates? For example, during “prime time,” Dow Jones news transcripts costs you \$1 per minute; stock quotations are 75 cents per minute. The rates drop dramatically in the non-prime time hours—essentially after 6 p.m.—to 20 cents and 15 cents, respectively. The telephone costs are built into the usage fees.

Typical costs for a session on The Source during prime time are \$18 per hour—about 30 cents per minute. The time is always computed to the nearest minute for billing purposes. However, as in the case of Dow Jones, evening time drops to \$5.75 per hour, and after midnight to \$4.25. There are higher rates for a higher speed transmission capability, but not every modem has it, and it's about 30 percent more than the standard charge.

In addition to basic access time, you can store data on The Source. The minimum charge is \$1 a month, and can build up to a charge ranging from \$5 to \$100 per month, depending on how much information you want to store. You can therefore store files, or maintain correspondence, or just about anything you wish. In fact, Los Angeles' Lewis states that his initial reason for going on-line with The Source was to use the data base as a computer—because he was only accessing the data through a terminal. “The

Source became a means for me to run computer programs in a time-sharing mode, in lieu of having my own computer,” he says.

The basic nut

Whether you want to store information on The Source or not, you will wind up paying a basic sum of money each month. The Source charges a \$9 usage fee, regardless of time charged, plus a 25 cent connect fee every time you log on. As a result, you can pay \$20 or \$30 a month with access rates of no more than two or three times a week—and can reach the \$50 per month range if you start to get addicted.

The bottom line as far as costs go is to remember that data bases are *not* free—which is why the bulk of data base usage takes place in the evening hours, when rates are significantly lower. And as much usage takes place after midnight as before; stories abound of programming and communications exchanges in the wee hours of the morning. By incorporating a clock mechanism in your computer, or using a modem (such as the Hayes Micromodem, which can work in conjunction with a sister chronograph product) the computer can be made to access data bases in the wee hours, although it still remains the province of the user to actually view the data, and decide what to use or download.

But what happens if you get on-line and can't sign off? In the early days of The Source, for example, the response time could lag 10 minutes or more, so an acknowledgment that you had logged off the service might not be forthcoming.

Don't fret. The major data bases use computer techniques such as “polling,” in which the data bases' mainframe computer is constantly asking its terminals, “Are you there?” If no answer is received, the computer will break the connection itself. Dow Jones' Perchonock says that no more than two minutes will

elapse before the connection is broken—so if you sign on and walk away to make a sandwich, watch-out—you could be disconnected.

The bills you receive from the data base providers reflect the variegated nature of their usage. Typical bills will include the base service charge; computed usage charges, based on minutes spent on-line; data-storage charges, where applicable; and tax. (By the way, if you access data bases as part of your business, the connect fees can possibly be tax deductible. It's something you should check out with your accountant.)

Using the bases

What has been the experience of individuals who use commercial data bases? If the market served is very specialized, such as legal or accounting functions, then no cost is too great. Time Sharing, Inc., located in Cupertino, Calif., provides accounting data for larger corporations and accounting firms. The data is accessed through company-supplied terminals, and can cost a large corporate user \$200,000 a year or more.

But for the personal-computer user, the data base still provides more than the enjoyment of just talking to other computer users via an electronic bulletin board, or playing computer games.

A typical reaction can be seen in the experience of GE's Gonzalez. While he admits he keeps his Apple II at home now, the concept of data base access and information retrieval is implicit in what he and his department do. “Data is our business,” he explains. “We sell data bases ourselves, and we also access additional data bases such as The Source, as well as more specialized data bases. No one has a lock on this business.”

As Gonzalez sees it, “we're highly trained analytical managers. We use the data we receive from the various data bases as a decision-support system. Because we're responsible for moving a great deal of money around,

Explore the excellence of your ZX81 with a

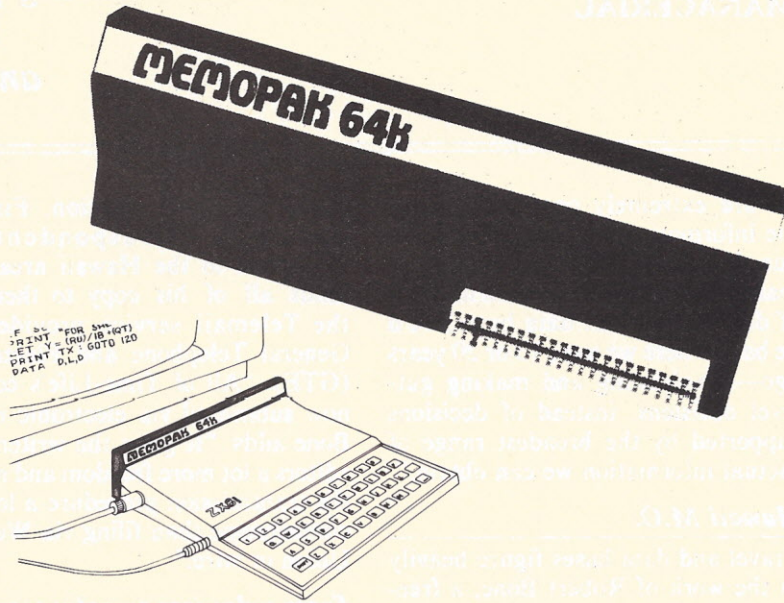
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Description of memory

0-8K ... Sinclair ROM

8-16K ... This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programs, and can be used to run assembly language routines.

16-32K ... This area can be used for basic programs and assembly language routines.

32-64K ... 32K of RAM memory for basic variables and large arrays. With the MEMOPAK 64K extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

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PROFESSIONAL/ MANAGERIAL

"Typical costs for *The Source* during prime time are \$18 an hour. Evening time drops to \$5.75 and to \$4.25 after midnight."

we are extremely concerned about the information we use to formulate our decisions. After all, when we make a mistake, it can mean millions of dollars. Without data bases, we'd be back where we were 15 or 20 years ago—hip-shooting and making gut-level decisions, instead of decisions supported by the broadest range of factual information we can obtain."

Hawaii M.O.

Travel and data bases figure heavily in the work of Robert Bone, a freelance writer based in Honolulu, Hawaii. Bone writes a syndicated travel column, centering primarily on South Seas and Australian locales, and uses electronic mail to send his copy. "Right now, I send my copy electronically to the San Diego *Tribune*," Bone says, "and I hope to add the Oakland *Tribune* to that as well." Bone doesn't use *The Source* for this; rather, he links his Xerox 820 directly to a Texas Instruments terminal at the San Diego paper. The paper's own data line number becomes the channel of transmission.

Bone admits that the process of communications is still imperfect. "I can't seem to generate the traditional journalist's paragraph symbol, at least in my copy," he explains. "And while many newspapers advertise the availability of data access numbers, they may not have anyone on staff who really knows how to get the data." Nevertheless, Bone reports a very favorable reaction from his editors. "They keep telling me, despite whatever format problems we might have, that they love being able to pull the copy right off the screen."

And Bone's electronic communications branches into other areas. As an author, he writes travel guides for Australia and New Zealand. Looking for updates on travel information, he was able to contact individuals in both nations via *The Source* ("It was just a local phone call, too," he recalls), and was able to update the information in time to

make his latest revision. Finally, Bone is a correspondent for Time-Life in the Hawaii area, and sends all of his copy to them via the Telemail service provided by General Telephone and Electronics (GTE). "All of Time-Life's copy is now submitted via electronic mail," Bone adds. "It gives the writers and editors a lot more freedom and makes the transmission procedure a lot less cumbersome than filing via Western Union or wire."

From palm tree to palm tree

It's a graphic response that Mark Waybuen receives from his data base usage. His firm, Island Services, is based on Catalina Island, off Los Angeles—yet communicates daily to a branch location in Orlando, Fla. How? Waybuen simply takes computer-generated graphics packages, reduces them to textual data instruction, and then sends them via *The Source* to the Orlando location. At that end, the data are received, and then reconstructed into a graphics image, using a graphics-oriented printer. "We use Source Files, rather than true electronic mail," he says. "We have a common mailbox, and either location can send or pick up data."

What's the benefit to Waybuen, whose firm is developing user graphics packages for the Apple II? "It's as if I was in two places at once," he explains. "Before this, we had to mail floppy disks between locations, before we could exchange graphics and see what we had. Now it's done virtually in real-time."

Waybuen also sees the benefit in terms of his company's ability to grow, and yet not be located in a major city. "We can now deal with large companies, in major cities such as New York, Los Angeles, and Chicago, without having to leave our island," he says. "It's hard for an artist, in particular, to survive unless he can make contact with companies. The data-base concept allows us to do

that remotely. It's the wave of the future."

Data bases have become more than just an avocation for Bob Sherman of Miami, Fla. Himself a *Source* user, he started his own data base in the Miami area last July—and currently reports a subscriber base of 260 members. "We started Miami's Big Apple as a free product, and now people pay to get on it," Sherman explains.

Sherman's exposure to computers began when he covered a tour of the Bee Gee's recording group in 1979. "While spending time in all of these cities, I wandered in and out of computer stores," he recalls. "I got to the point where I bought an Apple for myself, and for my son. He started to write programs for it—he's 10 and a half now—and I got into it myself."

Sherman, a journalist by trade, feels that "if you're a communicator, you need information. You should be able to access UPI, the major newspapers, and as many sources of information as you can."

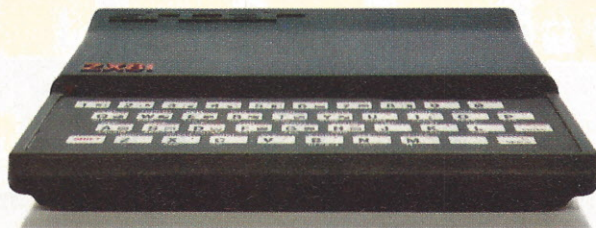
Thus, while Sherman's time is taken up to large degree with his own data base, he still accesses *The Source* four or five times a week to check the UPI wires.

"I've also used *The Source* for electronic mail, and I've made some friends via the Bulletin Board."

But Sherman sees a greater utility in data bases that's yet to come. "I really believe the day is going to come when everyone, including a housewife, will use a data base. Menu planning, for example, can be something accomplished via a data base. Or what if someone is on a diet, and overindulges one night? How do you calculate and restructure your diet the next day? You can't call your doctor. But there will be data bases to perform just those functions. And that doesn't even begin to scratch the surface. What about a data base shared between merchants in a specific area, that tells them who has

(continued on page 44)

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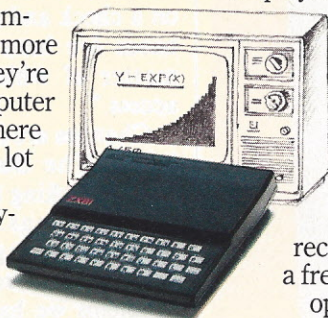
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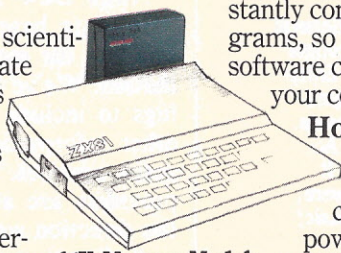
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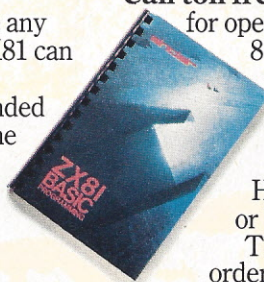
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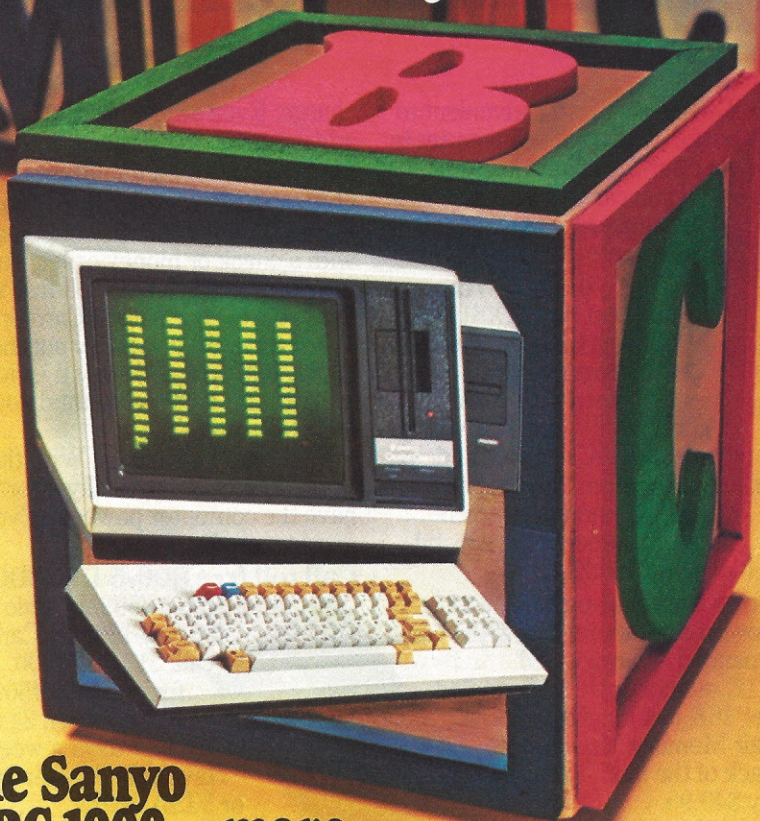
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PROFESSIONAL/ MANAGERIAL

DATA BASES


(continued from page 40)

been passing bad checks? All they would need to do is access the name on a check and verify it. I think data bases are here to stay. It's just a matter of which one you want to access."

Changes are indeed ahead for data bases. The Source's Rawls says, "We're looking to constantly improve our offerings. We've taken our program in stages. The first was to improve the response and access problems we had when we grew too fast—the *Reader's Digest* acquisition has helped to solve that.

"Secondly, we've worked on improving the usability of our current data bases. We now provide a simplified log-on guide, mailed to Source subscribers, to help them in that regard. And thirdly, we're working toward greater simplification of our access procedures for all of our data bases, as well as adding new services."

Adds Dow Jones' Perchonock, "The data base works best when it provides the user with quality information. We've broadened our offerings to include sports, weather and other information, as well as interactive services. The major data base providers are all perceiving that as the direction we must move in."

And, as the vertical data bases continue to grow, there is the likelihood that they, too, will broaden their offerings—and perhaps develop access capabilities so that personal-computer users can dial up full text retrieval for business, legal and accounting capabilities, as well as information and news retrieval. Thus, while difficulties still exist in regard to simple, consistent access to data bases, and the charges for such services will vary widely, there is little doubt that the personal computer can and will be a focal point for tapping into a world of information and assistance—whether the interest is for the home, or your business. 

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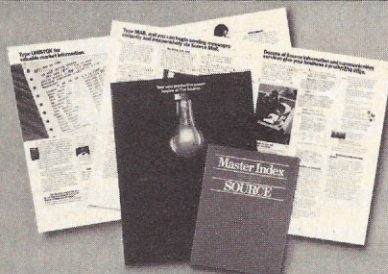
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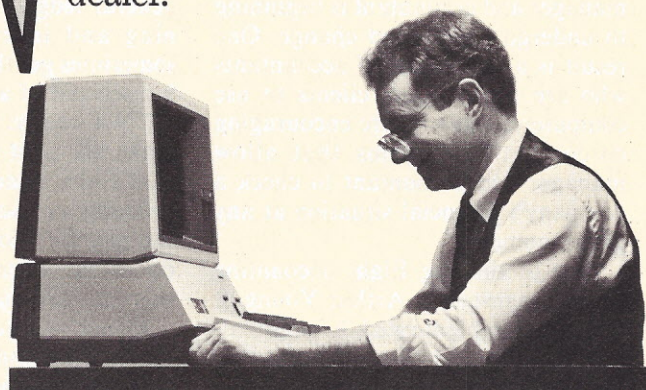
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Clients, Accountants Combine To Customize Number Crunching

To these accountants, it's off the green eyeshades and up the computer. And, it pays off for their clients

by Mark Fitzgerald

To many business managers, an accountant is someone who stops by the office occasionally to see how things went for the last three months or so. He may provide bad news or good news, but he always has old news. Even when a company uses its accountant as more than simply a bookkeeper or tax preparer, advice and financial planning are too often based on old information, or information that is too sketchy to be meaningful to the manager or even, sometimes, the accountant.

With the surge of personal computers into businesses large and small, however, the sometimes uneasy relationship between manager and accountant is beginning to undergo a profound change. One result is a new breed of accountants who are urging their clients to use computers, and who are encouraging co-computing systems that allow manager and accountant to check a company's financial situation at any given moment.

One of the Big Eight accounting firms, for instance, Arthur Young & Co., has implemented a personal-computer system that, among other features, allows client companies to simply store financial information on floppy disks and then turn them in for audits and analysis. And in many small accounting firms, CPAs are educating themselves about personal

computers, writing custom programs and eagerly following technological advances, particularly in software suitable for their small-business clients.

Follow the leader

Some accountants are aggressively moving into personal computers, and some are anxiously scrambling to follow the lead of their clients. William C. Foster, a CPA in Oradell, N.J., and an accounting professor at Rutgers and New York Universities, has been actively recommending computers to several of his clients, and most of them now own software in the traditional accounting areas: general ledger, cost and sales planning and inventory. Does Foster sometimes get the feeling he is selling himself out of a job?

"Not really. Personal computers make life a lot easier [for clients]—that's the benefit—and they have probably cut accounting fees. That's the payoff," Foster says. "But I endorse that. I don't want to cost clients more money than I have to."

Other accountants agree with Foster's assessment of the value of personal computers to their clients, especially corporate managers, and they go a step further.

Ira Weismann of I. Weismann Associates in Parsippany, N.J., says he has seen personal computers help many managers who don't know enough about what is going on in their companies.

"I have clients," says Weismann,

"who suffer sales losses, yet keep on a big labor force. Now, with the computer's help we can put them on a production schedule that is keyed to sales. Before, they used to lay off people too late—for no good reason. And all too often, by the time they did have a layoff their sales were already turning around."

Tracking figures in real-time

Weismann, who uses a Quantell in-house to track over 20 clients, and also several clients with Hewlett-Packard HP-125s, stresses other advantages of computerizing when recommending it. For instance, with available canned software, he tells the client, a company can track its billing through aging accounts-receivable programs, and it can follow its tax and sales situations on a real-time basis.

But some businesses are discovering that these basic accounting features are not as important as the planning capabilities personal computers are increasingly adding. Chris Schaker of Compag Inc., a San Francisco publisher and printing broker, bought a Symbiotic Systems STRATOS with software, including SuperCalc and Spellbinder, and a Qume Sprint 9 letter-quality printer after looking at "tons and tons" of hardware and seeking the advice of her accountant and an independent consultant.

"Obviously, account invoicing and proposal writing become easier with a machine. But more importantly,

Mark Fitzgerald is a reporter for The Herald News in Passaic county New Jersey.

“Computers make life a lot easier for clients—that’s the benefit. They cut accounting fees—that’s the payoff.”

because we are a very small company, to stay competitive we need quick access to good information,” she says. “The ‘what-if’ and cost-estimating features of the software give us what we need to know when we take on a project.”

For example, Compage’s bread and butter is brochure printing, and customers often ask how much a pamphlet would cost in 70 pound coated stock (paper) versus 80 pound. Not too long ago, Schaker’s answer was likely to be: Let me get back to you in a couple of days. “It takes hours and hours to do that kind of estimating manually,” she says. “We used to plan for a project by sitting over a long sheet of paper with pencils in our hands, going over long records, and probably missing a lot of stuff.”

A magical disk

At Compage, the STRATOS has also opened the door to the possibility of fully electronic editing to replace a system in which copy passes through several editing steps, only to be re-typed each time. “We want to be able to take this magical disk to the typesetter and bridge those crucial gaps in editing,” Schaker says. “We want to be right at the state of the art.”

Schaker says that just by performing those editing and estimating tasks, the system, which cost about \$9700, has paid for itself. “We consider this system to be our first employee,” she says. “I’d probably have to spend \$20,000 to \$25,000 for a person who could do all that it can, and, really, he wouldn’t be able to. Right out of the box the system is saving us a lot of money.”

Those accountants who fear they will be shut out by computerized customers should consider Compage’s new relationship with its accountant, Roy Wallace of Wallace & Mah in San Francisco. Schaker, if anything, is stepping up consultations with Wallace.

“The big advantage is being able to

sit down and analyze the figures together,” Schaker says. “You have an instantaneous idea of where the company stands, which is better than saying, ‘Gee, three months ago we should have done this or that.’” Ahead for the company, she says, is an upgraded system—right now, Schaker leans to a 16-bit Fortune computer with one floppy and a Winchester hard disk—which would be interfaced with Wallace’s office by floppy exchange or telephone line.

In for a change

Wallace has had personal computers since about three years ago, when they began to show up on the desktops of a handful of his clients’ offices and he sensed his profession was in for a big change. “Accountants aren’t known for leading anything,” he quips. “It is the client companies that are leading accountants into personal computers.”

As recently as last autumn, Wallace was still discouraging many eager clients from moving into personal computers. He had bought two Hewlett-Packard computers—the HP-85 and HP-125—and the Northstar Advantage, worked on the machines and experimented with a number of canned programs. He came to the conclusion that most of his clients would not be helped by the existing hardware and software.

“I think the biggest problem was the software,” he says. “The documentation was just terrible. The manual might say, ‘Enter the codes necessary to move the cursor in hexadecimal form.’ Do you understand that? Clients get more confused than anything else.” Wallace says a recent upswing in software quality—combined with a drop in hardware prices—now has him recommending personal computers to more clients. “At this point, there’s a whole lot of interest. I expect to see a lot of acquisitions this year,” he says.

But it is not clear just what accounting functions businesses should

be doing with their personal computers. The manager of a Computerland store in northern New Jersey reports frequent requests for “simple, down-and-dirty programs. Customers say, ‘Just give me something that will tell me who owes me money, and how much they owe me.’”

As a result, the manager reports that programs like the BPI (Austin, Texas) General Ledger are the most popular in what he says is a generally slow market for accounting software. BPI’s best feature is its capability for providing a good paper audit trail, says Peat, Marwick & Co. partner Richard Webb. However, for many businesses, he cautions, running the program on a personal computer “might be more costly because it takes so long to do it.” The larger companies would probably be better off running a custom program on a mainframe, Webb says.

Information overload?

San Francisco lawyer Lewis Reid is finding that out. For about a year now, Reid has experimented with a North Star Advantage in his home. Eventually he would like to use the machine for general ledger, billing and accounts receivable at his seven-lawyer firm, but he is finding out how easily even a small firm can swamp a personal computer’s capacity.

“For a law firm, the principal applications would be keeping time records and billing,” he notes. “But on some client retainers you have to keep time records for a year, and that’s just not practical with a floppy.”

Reid is working with the North Star General Ledger and Inventory Control programs developed by the Application Software Group of Vancouver, B.C. He has learned, to his frustration, that the software is written in a derivative of C. “It’s purposely a rather esoteric language so that it can’t be user-changed,” says Carolyn Schmauder of General Business Computer (Cherry Hill,

"I tell many of my clients, 'Computerize or you'll be killed.' If they get to know their businesses better, we'll all do well."

NJ.), which distributes the program.

Still, it should be noted that the accountant who keeps the books for the Cherry Hill software distributor uses only the records that are kept manually; he does not review the firm's North Star data base. And lawyer Reid says he is learning there are non-ledger personal-computer applications that will help his business a great deal.

"The graphics capability of the North Star interests me because a lot of the economics of a law firm depend on the presentation of financial figures," he says. "Graphics make it a lot easier to communicate. It's just bloody difficult to get clients to sit down and read financial reports and testimony."

Computers and numbers

Peat, Marwick, with its highly publicized large-scale purchase of Apple IIs in 1980, may have done the most to bring home the potential of personal computers in accounting. Since that time, partner Webb says, "we have acquired at least a dozen machines from almost every vendor that's out there." But the applications Peat Marwick is most excited about are similar to those anticipated by Reid's seven-member law firm. In fact, Webb notes, Peat, Marwick recently used an Apple III to prepare graphics for presentation during some complex financial litigation. During testimony in court, Peat, Marwick CPAs were able to quickly regraph data in response to questioning. "I think everyone in the profession is looking for a way to directly combine the graphics of an Apple or another personal computer into text from a word processor," Webb says.

The Big Eight have not forgotten auditing, however. Arthur Young put together what it is calling the first complete auditing computer to allow sophisticated financial analysis to be made directly on a client company's personal computer. The Arthur Young AuditComputer is designed to

increase the efficiency of auditing personal computers by eliminating the need for special programs for several different systems.

For a small company, the AuditComputer can transfer personal-computer data to minis or even mainframes, allowing more sophisticated testing and analysis. For large businesses with several far-flung divisions using a variety of personal computers and languages, custom AuditComputer programs can be written, eliminating the need for separate branch audits. "The whole idea is to get data off our client's machine and into a workable form, both on our computer and on our client's," Richardson says.

The AuditComputer's hardware consists of an Apple III with two 20-megabyte Corvus disks, plus an Altos ACS 8000-15. In addition, a custom-built remote data-capture unit is used to store and transfer data directly from a client's computer through an RS-232-C serial port or over telephone lines. The unit's 8-inch disk drives can also read IBM 3740-formatted diskettes.

Time, travel, taxes and costs

That's not to say that accountants aren't using their own in-house personal computers for records. "We put all our internal work on the Quantell," says CPA Weismann. "As a result we know exactly how much time we spent with a client, how far we traveled, what our bills are—and it even does all our tax returns."

There is still resistance to personal computers, however, and Arthur Young's Richardson believes this won't be overcome until computers become even more friendly.

"To date we've made people adjust to the technology," he says. "What is needed is a computer that will let people do their work as they always have. If there were a personal computer that was voice responsive—or, even more importantly, with voice input—the executive would be

able to operate as he did before."

Already, though, executives are asking to join what Richardson calls "this club." Some accountants have to remind themselves that personal computing is not for every business.

"I tell so many of my clients, 'Computerize, or you'll be killed.' After all, if they get to know their businesses better, then we'll all do well," says Weismann. "But, I do tell them that it is very important that they go to a consultant or a third party who can provide them with a turnkey system."

But the accountants don't have to do the pushing. Wallace reports that he expects that many—perhaps the majority—of his clients will purchase personal computers this year. And after two years of advising his clients about personal-computer options, Foster, the NYU professor who was interviewed shortly before April 15, said he would be making his own "very difficult decision" about computerizing soon after Tax Day.

Lewis Reid, the lawyer gingerly entering the personal-computing world, reflected the consensus of the new breed of accountants when he explained why he *really* bought his North Star.

"It isn't for the short-term benefits, like whether or not it can speed my accounts receivable," Reid says. "It's that the power of these machines has increased so dramatically as their size has shrunk, that it seems clear they will cause a revolution in office functions. The functions in my office—the receptionist, the secretary, the lawyer—are all roles defined by 19th century technology, and they are going to change. Lawyers will be their own secretaries, and with the communication capabilities, we may reduce the need for receptionists as gatekeepers of information."

"To a large extent lawyers and other professionals have persisted as keepers to the keys of the mysterious answers," Reid adds. "But that may be about to end."

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CIRCLE 27

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CIRCLE 29

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CIRCLE 34

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Uh...three legends.

heart of an Epson. So you still get a bidirectional, logical seeking, disposable print head, crisp, clean, correspondence quality printing, and the kind of reliability that has made Epson the best-selling printers in the world.

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Bidirectional printing	X	X	X	X	X	X
Logical seeking function	X	X	X	X	X	X
Disposable print head	X	X	X	X	X	X
Speed: 80 CPS	X	X	X	X	X	X
Matrix: 9 x 9	X	X	X	X	X	X
Selectable paper feed			X		X	X
PAPER HANDLING FUNCTIONS						
Line spacing to n/216		X		X	X	X
Programmable form length	X	X	X	X	X	X
Programmable horizontal tabs	X	X	X	X	X	X
Skip over perforation			X	X	X	X
PRINT MODES AND CHARACTER FONTS						
96 ASCII characters	X	X	X	X	X	X
Italics character font		X		X	X	X
Special international symbols				X	X	X
Normal, Emphasized, Double-Strike and Double/Emphasized print modes	X	X	X	X	X	X
Subscript/Superscript print mode				X	X	X
Underline mode				X	X	X
10 CPI	X	X	X	X	X	X
5 CPI	X	X	X	X	X	X
17.16 CPI	X	X	X	X	X	X
8.58 CPI	X	X	X	X	X	X
DOT GRAPHICS MODE						
Line drawing graphics				X	X	X
Bit image 60 D.P.I.		X	X	X	X	X
Bit image 120 D.P.I.		X	X	X	X	X
CONTROL FUNCTIONS						
Software printer reset		X		X	X	X
Adjustable right margin			X	X	X	X
True back space		X		X	X	X
INTERFACES						
Standard — Centronics-style 8-bit parallel	X	X	X	X	X	X
Optional — RS-232C current loop w/2K buffer	X	X	X	X	X	X
RS-232C x-on/x-off w/2K buffer	X	X	X	X	X	X
IEEE-488	X	X	X	X	X	X

*Tandy TRS-80 block graphics only available with GRAFTRAX 80.

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Coming Home: Blueprints For Success

Home-based businesses are being turned into outright success stories with grit, imagination and personal computers

by Margo Downing-Faircloth

In 1979, on a warm summer day in Columbus, Georgia, Gene Spalding and his wife were having a backyard pool party, and the air was crackling with excitement.

The Spaldings had been back from their honeymoon just five days and already he had set up a business deal that seemed to ensure a future of sweet success.

The exuberant groom was feeling so good about the future that he decided to take a fancy dive, which—in an abrupt instant—turned everything sour.

He broke his neck. At 33, Spalding was paralyzed from his shoulders down. He was left with only limited movement in one arm.

During the next six months—all of them in the hospital—his former business prospects waned. "My business partner stopped talking to me," he says, "and I decided to sell my business interest to him."

Spalding was jobless and in poor health, so—not surprisingly—his view of the future worsened. "Once out of the hospital, I spent about a year as sort of a vegetable," he remembers sadly. "I watched the soaps. I was thoroughly miserable. The problem was that I felt I couldn't do anything."

But in early 1981, an idea came to Spalding that, in time, has completely reshaped his life—and he now has a business that commands more

than \$25,000 a month in sales and another \$1000 in consulting fees.

With a background in electronics—Spalding graduated in 1972 from Cornell University as an electrical engineer—he decided to apply his technical skills to making a living by selling his computer knowledge.

"After talking to a vocational rehabilitation specialist," Spalding says, "I concluded that if I got a computer in my home, I could generate work from companies that either needed programming assistance or business consultation."

Spalding took a COBOL programming course at Georgia Tech-

nical College, where courses specially designed for handicapped people are offered. But commuting to the school was so difficult for him that he convinced Georgia Tech to allow him to take the course by telecommuting.

Now he does thousands of dollars in programming for small companies who have purchased personal computers, and need custom software for inventory control, accounting, forecasting, analysis of job costing and job worksheets.

"An awful lot of canned software is out there," he says, "but much of it, to be useful, still needs to be modified for particular needs. Take a pool company I deal with, for example. There is no software that I've been able to find to satisfy the special mix of their business, because they are a combination retail, wholesale and service organization. So I sold them a Watanabe plotting and drafting machine (Costa Mesa, Calif.), and then wrote programs for it. Now when a customer comes to buy a pool, the company inputs the size, design, etc. of the pool into the computer, and the drafting machine draws pictures of it to scale."

Spalding uses an Apple II Plus and a Commodore 8032 in his work. The Apple dials phone numbers and turns on lights and other fixtures in the house. The Commodore is his business unit. "To type on the computer, I use a typing stick," he says, "but I make so many mistakes that when I input numbers, I use a voice entry recognizer. I can put in about 40,000 numbers in two or three days."



Jeannette K. Oswald, a well known astrologer, provides computerized astrological charts for her clients from her home.

Margo Downing-Faircloth is a freelance writer and frequent contributor to Personal Computing.

"Providing The Source is an unusual attraction for a beauty salon, but it is only the beginning."



The other portion of Spalding's income, his consultancy, is mostly concerned with communications needs, such as the analysis of phone network bills. One of his clients is General Mills, where he has also worked out a telecommuting arrangement. By tying his Commodore machine into the conglomerate's mainframe system, he constantly receives up-to-date information from General Mills about the company's phone-use patterns. From this data, Spalding generates cost/benefit reports, which advise how General Mills might save money by shifting specific aspects of its phone usage.

In addition to his businesses, Spalding is a part-time instructor at the Georgia Warm Springs Institute—a center that became famous in the 40s as the site of Franklin Roosevelt's polio rehabilitation efforts. He says he intends to make his businesses an example for other handicapped people.

Barry Leonard has turned his center city brownstone into a computerized mecca of pampering. The personal computers at his beauty salon provide customers with access to The Source, videotapes of previous haircuts, and personalized appointment scheduling. He has tried to "create an environment where customers can enjoy themselves as well as get a good haircut."



photos by Everett Faircloth

"I think that using computers makes it possible for handicapped people to be competitive."

"I think that using computers makes it possible for handicapped people to be very competitive and make a reasonable amount of money," Spalding says. "With personal computing, it doesn't matter what you are, or where you are, or how many words you can type, or what color you are. It has really changed my life."

Spalding is obviously a person with determination, drive and imagination—the essential ingredients of a person who can make personal computing so effective as a business tool. He is also not alone.

With these three personality traits in tow, there are a growing number of small-business entrepreneurs who have brought personal computers into fledgling enterprises that operate out of their homes, and turned these questionable businesses into wholesale success stories. What they and Spalding all have in common is the willingness to try new methods and to search for better solutions, even those that may sometimes be of an unconventional bent.

An adventure of the future

Step into the computerized and wildly modern world of Barry Leonard who makes his hairstyling studio a futuristic adventure.

A royal blue door allows you to leave the noise, the smog and the fast pace of Chestnut Street in center city Philadelphia, and to get away from the street corner beggars and the tattered musicians. As you walk up the rust- and gray-colored carpeted stairs, you begin to hear a dominant overriding sound of pounding disco music.

At the top of the stairs—at the entrance to the hair salon—is an elaborately decorated fountain, which overflows into a large circular fish tank bolted to the floor. But the fish are not the average aquatic pets. Instead, they are Japanese Koi fish—large, fleshy, exotic creatures. Leonard constantly warns his customers: "You can talk to the fish or

pet them, but don't feed them or stick your feet in the pool.

"There is an expression in this business that we call 'the second cup of coffee,'" Leonard says. "We want to give people that second cup of coffee. And we don't want to give them special treatment the first time and never give it to them again. So what I've tried to do here is create an environment where they could enjoy themselves as well as get a good haircut."

Leonard has apparently been successful in doing that—and in improving his business—since he made dramatic changes at his beauty salon a year and a half ago. In fact, since he changed the "ambiance" and computerized his haircutting studio, his business has doubled.

There are three separate personal computers in his studio, all used for different functions.

Once you get in and register with the receptionist, you enter the waiting area—the front portion of the studio—where the windows are covered with canvas to allow for dim lighting and to block out the outside world. Here, chairs are built into gray, lavishly carpeted walls. In the center of this area, rust-colored chairs are made into a large rock-like structure, also covered with carpeting, each with individual overhead lights for reading.

But the most fascinating part of this waiting area is the IBM computer which is set up to allow customers to call up *The Source*, the information utility based in McLean, Va.

"The IBM computer terminal that's next to the pool is yours to use if you can figure out how to use it," Leonard tells customers in a brochure. "You can use it to play bridge, get the latest UPI news, a summary of news from *The New York Times*, shopping information or even make airline reservations. If you don't know how to use it, ask for help. But don't ask me because I can't figure out how the damned thing works."

If the customer can't figure out how to work the IBM, most of the hair stylists will help out. And it is not unusual in Leonard's studio to see customers having their hair done while reading printouts from *The Source*, instead of the usual outdated, torn magazines.

A watchful eye

Providing *The Source* may be an unusual added attraction for a beauty salon, but it is only the beginning. A computer-operated video system, suspended from the ceiling in the cutting salon, encased in a glass bubble, keeps a mindful eye and records every hairdressing session. Color video monitors, built into the walls at each station, enable the customer to see what is being videotaped and to watch various angles of their hair being shorn.

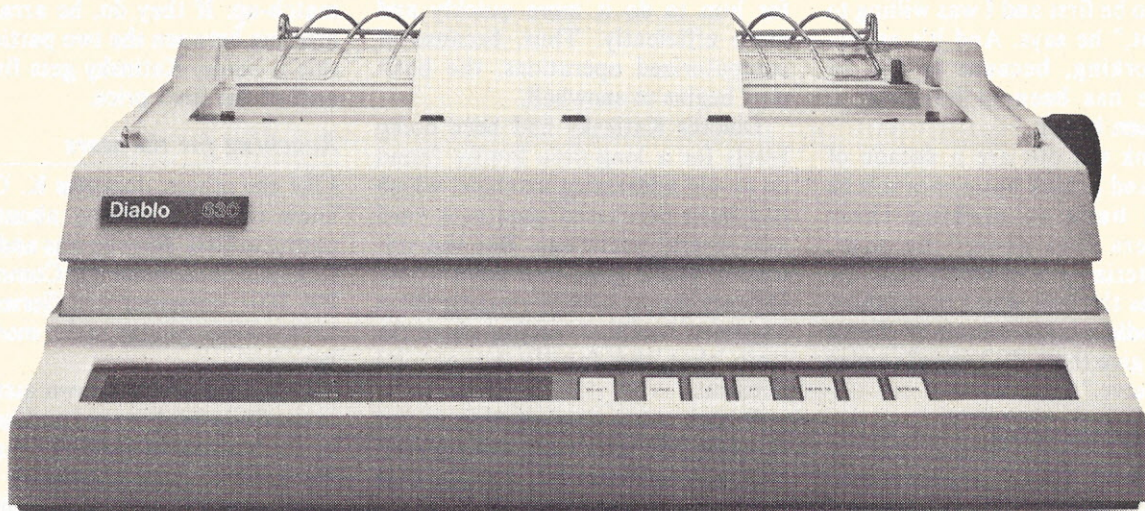
The tape is catalogued and indexed in the memory of two Sony programmable autosearch controllers that are powered by microprocessors. The tape is recalled on the customer's next visit to the salon.

"We can actually give a better haircut, because we can review what we did during previous sessions," Leonard says. "We can repeat the style if the client liked what was done in the past, or the client can show us what he didn't like. And we can also use it as a frame of reference for hair growth."

The third of Leonard's three computers is in the stock room. This TRS-80 Model III Microcomputer, with two disk drives, is used for filing client names, addresses and appointment dates.

Leonard says that although he knows very little about computers, he understands their potential in his business. "In the future I plan to sell franchises," he says, "and with our computerized video system, clients in any part of the country will be able to view the last cut or any cut they wish. All it takes is thinking about how to give a better quality haircut using

If you want a choice in print wheels, here's the first choice in printers.



The Diablo 630.

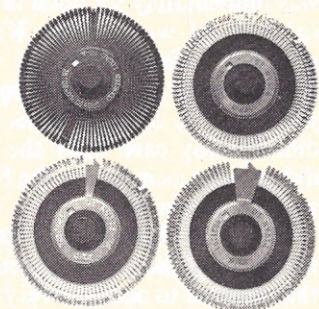
It's the first printer that lets you use either metal or plastic print wheels. So you can choose the print wheel that's just right for the job.

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CIRCLE 35

"The computer is renewing the old American entrepreneurial urge, and spurring home-based businesses."

some of the latest technological benefits."

Leonard, who is affectionately called "Crimper," concedes that his modernization has been expensive, with an initial investment of \$11,000 for the video camera alone. "But I wanted to be first and I was willing to pay for it," he says. And it's apparently working, because in the 28 years he has been in business, it hasn't been better.

"I think the 80s are a decade of feeling, and I think businesses will be getting back to making their customers feel good," he says. "Computerizing and revamping my decor was the best way I could think of to handle a large volume of clients and still give them the type of service they deserve."

The American spirit

With cases like Spalding and Leonard, it is clear that the personal computer is renewing that old American entrepreneurial urge and spurring the growth of small businesses operating out of the home. Examples are varied, and sometimes people are able to succeed in spite of an initial dislike for computers. Consider the story of the Katinskys.

When the TRS-80 first made its appearance in the Katinsky home, it was immediately set upon in a familial tug-of-war. Jack Katinsky grabbed it for budgeting. His two kids invaded space and regions beyond with it. And his wife, Dolores, didn't really care what the TRS-80 did, as long as it was in the basement and out of her way.

But today Dolores regrets her heretical thoughts. The expensive toy that seemed to occupy every free and waking hour of her husband's time is now reaping unexpected income for the family. By working on the computer, she suddenly has a rapidly growing mail advertising business, and Jack recently started a computer resale agency. Both businesses are thriving, and both function

out of their Cherry Hill, N.J., home.

In many ways the Katinsky story is not unusual. Specific business applications on the personal computer are often built on something a person is already doing. The computer makes his work easier and makes it possible for him to do it more quickly and more efficiently. Thus, because of computerized operations, the business begins to snowball.

Dolores Katinsky had been doing labels for a long-time family friend on an old addressing machine, which had been purchased used at a yard sale several years ago. But the volume of labels grew to a point where Dolores simply couldn't handle them anymore. And that was just about the time that the family bought its TRS-80.

It took some reorientation in her thinking, but before long the personal computer became the workhorse of her business. She typed all of the label names on the Model I computer and saved them on a disk. This meant that she didn't have to retype the list twice each year or stamp out each label manually anymore. The job that formerly took her more than four hours now takes her 15 minutes. And she has been able to expand her business to nearly 20 accounts as well as offer a complete mailing list and mail advertising service. She calls her business "Direct Approach."

The move to upgrade

Dolores has become so dependent on the thing she initially loathed, that she recently invested in a later model of the TRS-80, two additional printers and an eight-inch floppy disk drive.

After watching his wife's success, Jack began a computer resale business last fall. Katinsky uses the Radio Shack Profile II program as his database manager. He says he is currently selling from five to seven systems a month, without really pushing.

Most of his business has been generated from ads placed in local news-

papers and word-of-mouth response. When a customer tells him what kind of equipment he wants to sell or buy, Katinsky puts the request on the TRS-80 data-base program, and cross-checks to see if the needs of any of his potential buyers and sellers match-up. If they do, he arranges a meeting between the two parties. If a sale is made, Katinsky gets five percent of the final price.

Reaching for the stars

Like the others, Jeanette K. Oswald knew virtually nothing about computing at first. But she was and still is determined to make her Commodore Pet 2001 computer and Series 4022 Commodore printer make money for her.

Oswald is a well-known astrologer in the Philadelphia area and has been in the business of reading charts and doing astrological counseling for 10 years. For the past several months, she has been using her computer to calculate and print out astrological charts, and her goal is to increase her business by providing printouts to other astrologers who don't own personal computers.

Using a program published for astrologers by Matrix in Big Rapids, Wisc., Oswald first inputs a person's name, and date and place of birth. "The computer figures the aspects, which is the customer's planetary placements," she says, "and the relationship of the planets to each other. It also tells me mid-points or spots between the planets, which are also important astrologically." The whole range of information is then charted on a circular printout containing 12 pie-sections.

Each chart takes about five minutes to complete in her modest home office in the northeast section of Philadelphia, where the most obvious decorations are her zodiac and sun signs on the wall. "The charts help me to define characteristics of a person," Oswald says, "his potential workwise, areas in which he might be

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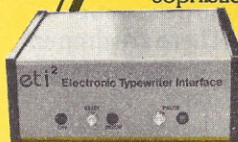
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BUSINESS

happy, and his compatability with other signs."

To do the calculations manually would take about a half hour, she says. In addition, by hand she would have to make adjustments for each of the planets, which takes another half hour. And calculating the mid-points could take another hour or more.

Initially, Oswald says, when she first floated her idea of computerized horoscopes to other astrologers, they shied away from taking her up on her offer. But recently she has gotten calls from a few who expressed interest.

Her clients, though, were never put off by the computer-generated charts, because they get the information they are seeking that much more quickly.

Make or lose that money?

Most of the personal-computing success stories you hear these days—including those contained in this article—end up with somebody making more money than before. There are exceptions, though, such as Jerry White of Prospect Park, Pa., who gives away his computer expertise for free. All he expects in return, he says, is a friend and, if he should need it, a favor.

When you walk into White's house, it isn't hard to see that he is a somewhat unusual character. He has two dogs, a cat, a guinea pig, two short-wave radios, three separate telephone lines, close to a dozen Rubik's cubes, and an Apple II Plus personal computer.

Then he starts rattling off about belonging to seven computer clubs and three ham radio clubs, about being the safety services chairman of the ChesterWallingford chapter of the Red Cross, and about his work as a state-registered emergency medical technician.

White is admittedly the type of person that rarely slows down—the type who always has something to do, a deal to make, a place to go to meet

people. But still he spends a lot of his spare time at home repairing Apple computers for free.

As with many of his involvements, this was not something he planned to do. Around Christmas time in 1978, White's 48k Apple II Plus stopped working. "My buddy came over and we tried to fix it," he says. "But we weren't successful, so I took it to the store where I bought it. They told me they couldn't fix it until the next day."

"At that point, all I could think about was my friends who were coming to my house for the holidays, and me wanting to show off my new computer, and it not working."

"Anyway, the next day I picked it up. It was fixed, but there was a minimum service charge of one hour—that was \$35—plus another \$2.50 for a (computer) chip, plus six percent tax."

"I was upset at what I considered the high labor costs, so from then on I simply bought chips at the best prices and started fixing my computer myself."

Then one night at about 11 o'clock, a friend of his called and he was "frantic," White says. "He's a school teacher and he uses his machine at school. Well, he had actually blown holes in his chips."

The word got around about White's work. He has since fixed machines for several people. In fact, he has fixed one woman's machine three times, he says, and people literally call him any time of the day or night.

Operating a successful business from one's home has always been one of the riskiest ventures to attempt. Careful, well thought-out planning should be done before anybody jumps in with both feet and with all his money. Drowning is not unusual. But as the tales in this article attest, at least in many cases, fitting the personal computer into one's small-business plans can often be an important springboard in propelling a firm's flight.

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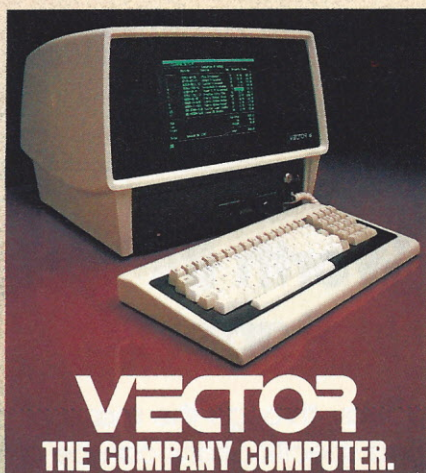
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CIRCLE 36

If It's Worth Its Weight In Paper...

Finding your way through the maze of printer requirements and specifications can be a herculean chore. This special report attempts to ease the burden

by David Gabel

Editor's note: To aid you in your search for the proper printer, our researchers developed a comprehensive chart of printers and printer features, which begins on page 71.

A printer is one peripheral that you can do without, but probably not for long. The day will come when you need to get a copy of your work from here to there, and the only way to do it is on a piece of paper. In that case, you need a printer—the only device that lets your computer show people what it has done in a form that's easily transported.

A printer can be the most expensive peripheral you buy. In fact, depending on the type of computer you have, and the type of printer you buy, it's not unlikely that the printer will cost more than the computer did

David Gabel, the editor of Personal Computing, has been known to turn out hard copy at 20 cps.

in the first place. So it behooves the cautious computer user to study the available printers carefully to make sure he gets the one he needs, but doesn't spend too much.

In the search for that perfect printer, users will find that the machines come in many versions. They can cost as little as a few hundred dollars, or as much as tens of thousands of dollars. In this report, we'll be talking about printers that are a little more expensive than the minimum, and a lot less expensive than the maximum. We will limit ourselves to printers that can print at least 80 characters on a line, which leaves the really low-cost printers out. Such low-cost printers are probably not for general business applications, but there are applications, such as ticket printing, for which the machines are well suited. Similarly, we won't discuss line and page printers, except to mention some of the more esoteric technologies involved with these printers.

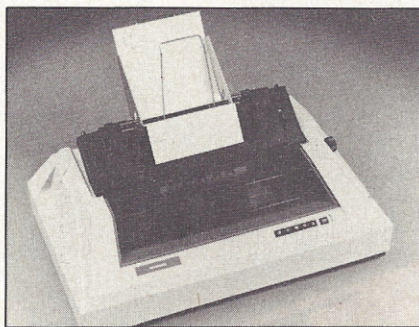
Keeping those limitations in mind, there are basically two types of printers—impact and non-impact. But there are, in addition, two other basic types of printers—letter-quality and dot-matrix. And just to confuse matters more, there are letter-quality impact and non-impact printers, and there are dot-matrix impact and non-impact printers.

Diving in

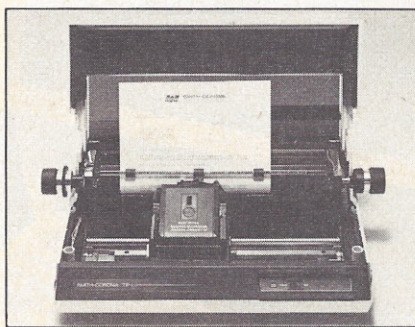
Dot-matrix printers, one of these options, are usually the lowest of the low-cost printers. But, the cost depends on the printer in question.

Dot-matrix printers make characters that are composed of small dots. The bill you receive from almost any corporation that uses a computer to generate its invoices these days is printed with a dot-matrix printer, so most people are familiar with the way the characters look.

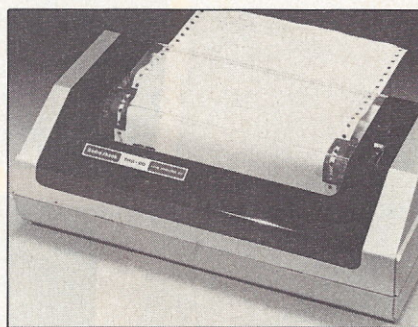
The method these printers use to generate the dot patterns varies



The new WP-6000 printer from Anadex produces correspondence-quality printing at 150 cps.



The Smith-Corona TP-I is a daisywheel printer that sells for slightly less than \$1000.



Radio Shack's Line Printer VII uses a pin-feed mechanism, so paper is always aligned properly.

“It is very possible that the purchase price of a low-cost printer can be completely overshadowed by the cost of operation.”



Trilog's Colorplot printer produced the pattern shown. It develops almost true color by overprinting cyan, magenta and yellow. The colors are arranged in different sections on a special ribbon.

One of the great masters?

Although the Datasouth DS180 matrix printer may not exactly rate as a work of art, our customers have a *very* high opinion of its value. Over the past year, we have shipped thousands of DS180 printers to customers throughout the world. Many of our sales now come in the form of repeat business—a strong testimonial to the acceptance of a product.

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Recently we introduced new enhancements to make the DS180 printer even more versatile. Dot addressable raster scan graphics produces output of computer generated charts, maps and graphs at a resolution of 75 x 72 dots per inch. Variable horizontal pitch selection allows printing at 10, 12 or 16.5 characters per inch plus double wide printing at 5, 6 or 8.25 characters per inch. The expanded 2K FIFO print buffer handles a full CRT screen dump at up to 9600 baud without delaying the host system. We also offer transparent mode for isolating communications problems, and for APL users, the dual ASCII/APL character set option.

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- Top of Form
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- Vertical Tabs
- Perforation Skip-Over
- Auto Line Feed
- 6/8 LPI
- Auto End of Line Carriage Return
- 5 IPS Paper Slew
- Parallel and Serial Interfaces
- 110-9600 Baud Communications
- Terminal Status Indicators
- Audio Alarm
- Self-Test
- X-on, X-off
- Paper Out Detection

OPTIONAL FEATURES

- Compressed Print—10, 12, 16.5 cpi
- High Resolution Dot—
- Addressable Graphics
- 2k Expanded Print Buffer
- APL/ASCII Character Set



The DS180 is available nationwide through our network of sales/service distributors.



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"Important factors to consider when buying are print quality, speed, durability, reliability, options, interface ease and cost."

greatly, but probably the most common is the impact type. With impact printers, fine wires strike an inked ribbon and force the ribbon against the paper, making a dot in the same way that the common office typewriter prints letters and numbers. The different character shapes are formed by the way the wires strike the ribbon. The electronics inside the printer determine which wires should be "fired" at the ribbon, and at what time the firing should take place. At the appropriate time, a signal is sent to the printhead, which moves along the paper, that overcomes the force of a magnet that has been holding the pins away from the ribbon. When the force of the magnet is overcome, the wire is pulled forward by a spring—fired—and strikes the ribbon, and thence, the paper.

Electrostatic-discharge printers, on the other hand, operate by placing a high voltage on the pins when they are in a position to place the dots that form the characters on the paper. The voltage discharges to the paper, which is aluminized, and in the process removes a dot of the aluminum coating. These non-impact dot-matrix printers are very fast, but many people object to the glare of the silver paper.

Thermal dot-matrix printers have yet another method for placing the dots on paper: heat. These printers also use a special paper, but unlike

electrostatic printers, thermal printers use heat-sensitive paper. As the pins on the printhead reach the appropriate place to make a dot, the printhead is heated and discolors the paper at the correct place.

The disadvantage of these thermal printers is, again, the paper. There isn't any bond paper made for these printers, and the paper they use has roughly the same texture as the paper used for adding-machine tapes.

The advantage the thermal printers have is their speed and quiet operation. Another advantage of these thermal, and indeed all non-contact printers, is that they don't have fast-moving parts that slam into hard objects. That means they're inherently more reliable than printers that contain pieces of metal that move and strike at a very high speed. So, reliability can be a very important consideration if a printer is to see heavy use.

Also, beyond their speed and reliability, non-impact dot-matrix printers shape their characters electronically. The character sets are typically stored in ROM, so if there is a need to switch from Roman to italic characters, or from English to Arabic, or whatever, the conversion is relatively simple. The user will find that he can often buy a second ROM for alternate characters, or that a second set of character instructions can be loaded into a buffer on some printers

directly from the central processing unit.

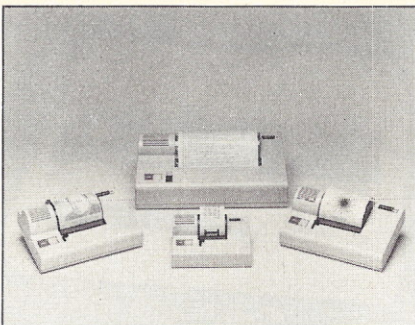
Dot-matrix printers have been criticized over the years since their introduction because of the poor quality of their characters. If you select the kind of characters made by an IBM Selectric typewriter as the standard of quality for correspondence, then the dot-matrix printer falls far short. Its characters just don't measure up by the very nature of the printing process.

The quality question

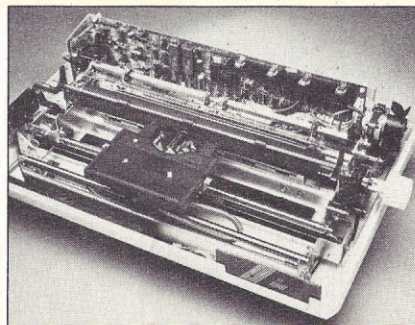
Dot-matrix-printer manufacturers, recognizing this deficiency, have come up with two different approaches to make the dot-formed letters look more fully formed.

The first approach is to put more dots into the matrix, accomplished by simply adding wires to the printhead. Some printheads are composed of a single row of about seven wires, but more printers are appearing with nine wires in a single row, or with double rows of wires. The additional wires allow more dots to be closely placed, so the image of the character is denser, and more like a fully formed image.

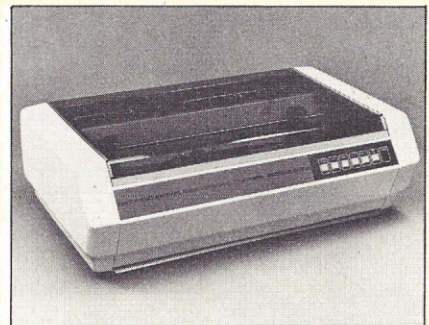
The second approach to upping the quality of a dot-matrix printer is to use more than one "pass" of the printhead to accomplish the printing. (A pass is a single traversal of the paper by the printhead.) On the second



The Alphacom 84 (center), like others in the company's line, can provide gray-scale graphics.



A Qume Sprint printer, minus its cover, reveals the daisywheel print mechanism and the ribbon cartridge.



Dataroyal's IPS-5000-A prints at 150 cps and has both compressed and extended fonts.

SPECIAL REPORT

"Daisywheel and thimble printers provide fully formed character printing—often at an acceptable cost."

pass, the dots are positioned just slightly away, horizontally or vertically, from the locations where they were printed on the first pass. The net result is a set of overlapping dots which make the characters look more fully formed.

The problem with such an approach is the difficulty of getting the dots so closely aligned. The closer the dots, the more complex the electronic and electro-mechanical systems to put the dots where they're supposed to be. Murphy's law says that whatever can go wrong will go wrong, and the more complex a system in terms of its number of parts, the more can go wrong. So dot-matrix printers with more fully formed characters—so-called near letter-quality printers, called correspondence-quality printers by some firms—have some inherent reliability difficulties that are not shared by the simpler dot-matrix printers. Such difficulties are surmountable, but the buyer should be aware that they exist.

Comparing them

When looking to purchase, the buyer should also be aware of the several measures that can be used to compare dot-matrix printers. The first and most obvious measure is the quality of the printing itself; simply look at the output of the printers under consideration. Be sure to check for any enhanced mode printing

that's available, because enhanced mode makes the printing darker on some inexpensive machines. Also check the printer for any multipass printing, which will make the machine suitable for correspondence-quality applications. In addition, note the speed degradation that occurs when the printer is put into its multipass mode; it's easy to see that a printer will run half as fast if it has to make twice the number of passes to complete a line of print. (Dot-matrix printers run at a few hundred characters-per-second when they operate in data-processing mode, the name given to the print mode that has no enhanced and no multipass printing.)

Another point of comparison is the machine's method of paper feeding. If your application will call for a lot of single-sheet feeding, be sure the printer accepts single sheets easily. But, if you'll be doing a lot of single-sheet feeding, it can get to be a real bother very quickly. (Single-sheet feeders aren't the answer here—they're quite expensive.) If your application will call for printing on continuous forms—either fan-fold or roll paper—the printer only needs loading occasionally.

For those who decide to bypass dot-matrix printers because they require characters on their correspondence that look fully formed, there are letter-quality printers available.

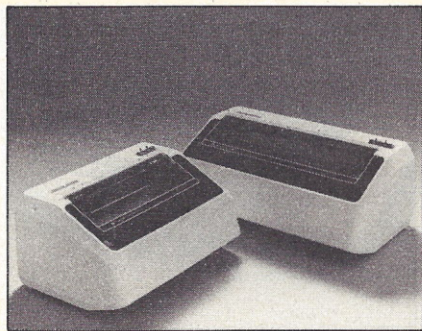
These machines also come in several versions, with different print mechanisms to accomplish printing in a variety of ways.

The two kinds of letter-quality print mechanisms most commonly used with personal computers are daisywheel and thimble printers. These two mechanisms, which print one character at a time, provide fully formed character printing often at an acceptable cost, depending on your pocketbook size.

Daisywheel printers have a print element that, as the name implies, looks like a daisy blossom. There is a central hub, and from it spokes radiate that have characters embossed on their ends. The central hub fits onto a drive shaft that rotates the wheel when the printer is in operation, and the daisywheel rotates between a ribbon and a print hammer. As the appropriate embossed character is in printing position, the hammer fires, forcing the character to strike the ribbon, and the ribbon the paper, printing the character.

It's easy to imagine that there are fairly significant timing considerations involved in this device's operation, because there are two distinct motions that must be carefully controlled. The rotation of the wheel must bring the proper character into print position at the same time that the printhead's horizontal motion

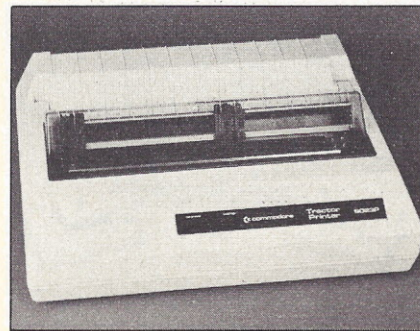
(continued on page 76)



Integral Data Systems' Prism printers feature fixed and proportional character spacing.



The 7030 from Qantex Division of North Atlantic has four effective character-printing speeds.

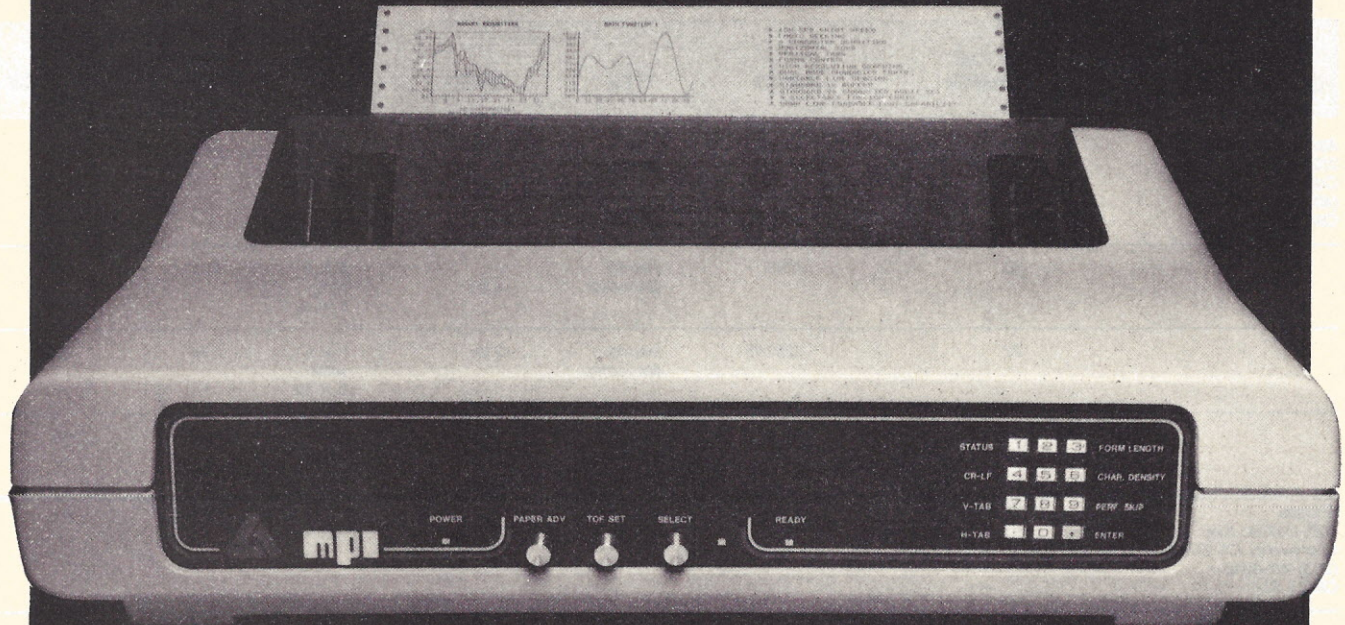


Note the moveable feed-pin assembly on this tractor printer from Commodore Computer.

Features Of Popular Printers

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
Alphacom, Inc. 2323 S. Bascom Ave. Campbell, CA 95008 (408) 559-8000 CIRCLE 320	20	\$175	thermal dot matrix	2 lps	5 × 8 within 8 × 10	2.37"	Yes
	40	\$295	thermal dot matrix	4 lps	5 × 8 within 8 × 10	4.34"	Yes
	42	\$249.95	thermal dot matrix	2 lps	5 × 8 within 8 × 10	4.34"	Yes
	84	\$595	thermal dot matrix	4 lps	5 × 8 within 8 × 10	8.74"	Yes
Anadex 9825 DeSoto Ave. Chatsworth, CA 91311 (213) 998-8010 CIRCLE 321	DP-9500A	\$1000	dot matrix	120 cps 200 cps	7 × 9 9 × 9	220 col.	Yes
	DP-9000A	\$900	dot matrix	120 cps 200 cps	7 × 9 9 × 9	132 col.	Yes
	DP-9620A	\$1100	dot matrix	100 cps 200 cps	7 × 9 13 × 9	220 col.	Yes
	WP-6000	\$1825	dot matrix	150 cps 300 cps	7 × 18	220 col.	Yes
Anacom General 1116 Vallencia Dr. Fullerton, CA 92631 (714) 992-0223 CIRCLE 322	150	\$1495	dot matrix	150 cps	9 × 9	132 col. 80 col.	No
	150 Z	\$1895	dot matrix	150 cps	9 × 12	132 col. 80 col.	Yes
	160	\$1750	dot matrix	150 cps	9 × 9	132 col. 80 col.	No
	160Z	\$2150	dot matrix	150 cps	9 × 12	132 col. 80 col.	Yes
Apple Computer Co. 10260 Bandley Dr. Cupertino, CA 95014 (408) 996-1010 CIRCLE 323	Silentype	\$395	thermal dot matrix	up to 40 cps	5 × 7	8.5"	Yes
Atari, Inc. 1265 Borregas Ave. Sunnyvale, CA 94086 (408) 745-2000 CIRCLE 324	825	\$799.95	impact dot matrix	50 cps 83 cps 79 cps	7 × 8	80 col. 132 col.	No
	IMP-4	\$699	dot matrix	100 cps	7 × 9	1.5-9.5	Yes
Axiom 1014 Griswold Ave. San Fernando, CA 91340 (213) 365-9521 CIRCLE 325	GP-100	\$389	dot matrix	30 cps	5 × 7	9.5"	Yes

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LPM for average text, and as many as 226 columns on 15 inch wide paper. That's speed in two directions. Dot graphics; a full 1000 character buffer (with up to 8000 character capability optionally available); and an optional non-volatile soft-switch keypad for configuration selection and retention. All dressed up in sleek, attractively styled casework. ☐☐☐ Set your sights on performance, versatility and extended capability with the MP150G Wide Carriage Dot Matrix Printer from MPI. It's worlds apart from the ordinary.

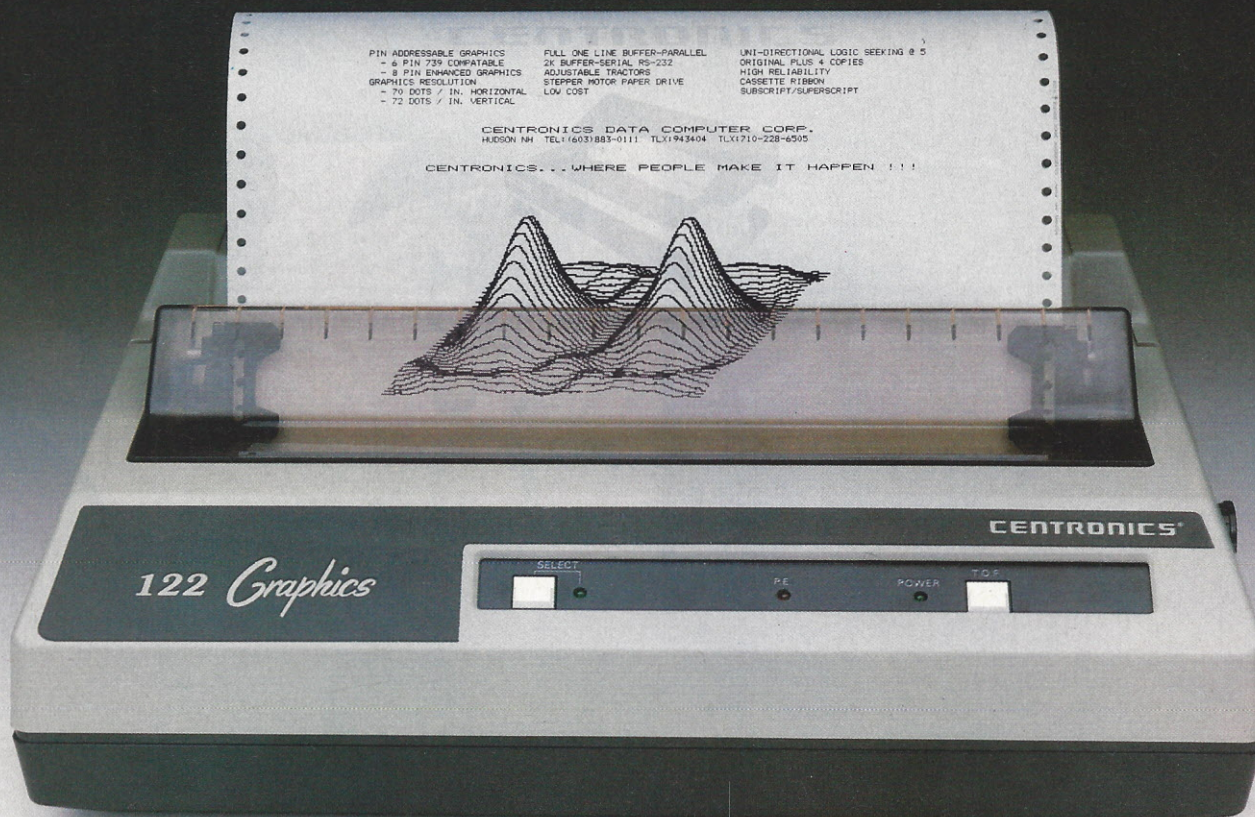
*Suggested list price. Substantial OEM discounts available.



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THE NEW CENTRONICS 122 GRAPHICS PRINTER.



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When you look for a printer, take a good close look at the critical points that separate a professional printer from the toys.

Look at the factors that add up to reliability. Look at the built-in operating features. Look at the service. *Then*, check the price.

We did. Then we built the "122 Graphics." That's why we'll stack it up against any desk-top printer. Especially the toys.

IT'S PRICED FOR VALUE

The "122 Graphics" is truly a commercial grade printer, but its price is comparable to the top-of-the-line toys. You see, even most of the toy printers lose their price advantage when you add the options that are standard on the "122 Graphics."

IT'S BUILT TOUGHER

The "122 Graphics" uses the same technology as the work-horse printers that have made Centronics the top choice among OEM's in brand preference studies. And, it provides the high reliability and low cost of ownership required by the professionals.



IT DOES MORE

If you want features, built-in, not added on, use the "122 Graphics" for comparison:

- 132 Column Paper Width
- Adjustable Tractor Width • Forms Handling—up to 5 parts • Graphics—Business and Image Graphics 6- and 8-Pin Switch Selectable • Large Library of "Off-the-Shelf" Software • High Throughput—120 CPS Bi-Directional Operation.

WITH BETTER SERVICE

Centronics has the largest network of factory service and walk-

in service centers in the printer industry. Not third-party service—**FACTORY SERVICE!** Worldwide. Ask the competition about service.

What's your computer? IBM? Apple? TRS-80? Xerox? Atari? It doesn't matter, the "122 Graphics" has the software flexibility to interface with virtually every one of them and many others.

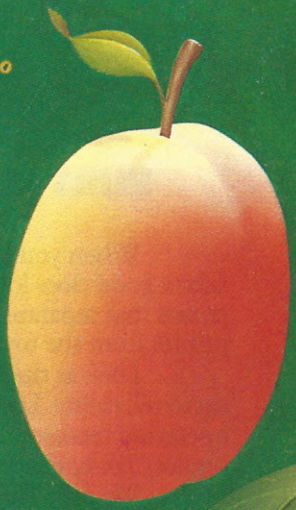
And finally, consider this. The "122 Graphics" is from Centronics. The company that has built and sold nearly half a million printers to businesses and OEM's of every size worldwide.

See your nearby authorized Centronics Dealer or Distributor soon and see first hand why the toys are no match for the Centronics "122 Graphics" printer.

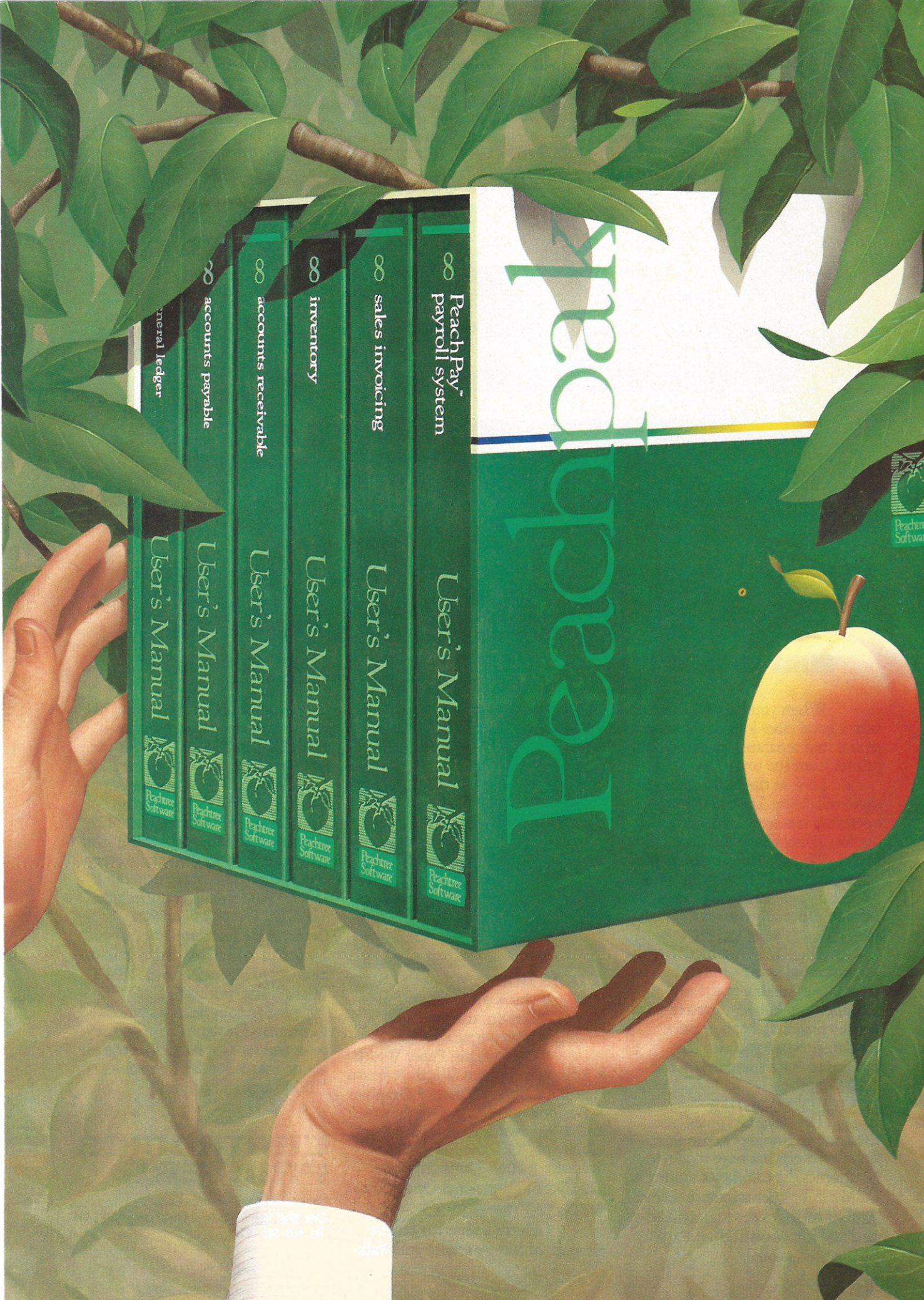
CENTRONICS[®] PRINTERS

Centronics Data Computer Corp.
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The Peachpak 9 Office Productivity Series is centered on the PeachText™ word processor (formerly Magic Wand®; we've improved it and like the results so much we decided to put our name on it) and includes the PeachCalc™ Electronic Spreadsheet, Spelling Proofreader, Mailing List Manager and Telecommunications. Peachpak 9 extends the Peachware solution to all areas of the electronic office.

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needs, for vertical applications, even one designed specifically for the Apple II™ computer.

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We're bringing these services to more people every day, both in the United States and abroad, through our network of almost 1,000 dealers and Peachtree Software International, headquartered just outside London. We have more than 40,000 packages installed worldwide, and the number is growing rapidly.

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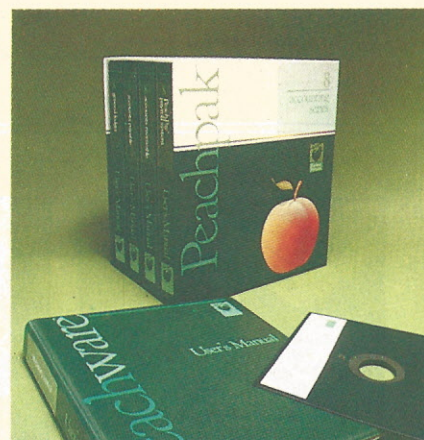
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Accounts Payable Payroll
Accounts Receivable

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Accounts Payable Payroll
Accounts Receivable

Peachpak™ 6 Client Accounting Series

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CIRCLE 23



SPECIAL REPORT

"When shopping for a printer, be sure to check for any enhanced mode printing that's available."



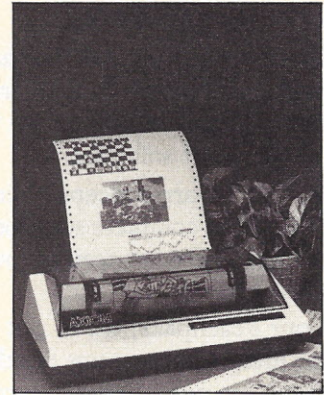
Epson printers include the MX-80 and MX-100, which prints a full 132 columns.



The Apple AP-PAK from MPI lets the Apple II use the capabilities of MPI's printer.



Up-front controls make set-ups easy on Mannesman Tally's MT-1800 serial printer.



The GP100 from Axiom handles text and graphics with aplomb, and costs under \$400.

WORTH ITS WEIGHT?

(continued from page 70)

gets the whole assembly into print position. If the timing is off, the characters will be cocked one way or the other, or the inter-character spacing will be incorrect.

Daisywheel manufacturers have solved these problems, but there's a considerable cost to the user, and the machines are comparatively slow. Forty characters-per-second is a pretty respectable speed for a daisywheel.

Noise, too

Daisywheel printers are also fairly noisy, a problem when the printer will be used in a crowded office. The

hammers fly forward at considerable speed, and there is a fair amount of energy that is dissipated when the spokes of the wheel hit the ribbon. The mass needed to move the character spokes around makes the impact fairly hard, and the machine gives off audio-frequency vibrations that sound similar to the discharge of a .50-caliber machine gun. So most people who have to use a daisywheel will quickly find a way to put it into a sound-insulated room, or buy one of the several cabinets available that muffle the noise of the printer. If printer noise will be a consideration, be sure to take the possible need for an enclosure into account. Radio

Shack offers such a cover for its Daisywheel II printer for \$399.

One advantage of using a daisywheel is that the machine's printed character set can be changed. As with the IBM Selectric typewriter, the print elements are interchangeable, and come in a variety of character fonts. Different type styles are thus available, but graphics aren't, except for the kind often seen in arcades where an image is made by printing and overprinting characters in a particular area of the paper. Such graphics must be generated in the computer itself, rather than in the printer.

(continued on page 124)



Apple Computer's Silentype printer has an almost soundless thermal printhead.



The PC-8023 printer from NEC, on top of the disk drives, handles dot graphics printing.



The Centronics 122 printer employs an industry-standard parallel interface.



The DP-8480 from Star Micro uses bidirectional, logic-seeking printing.

(continued)
**FEATURES OF
 POPULAR PRINTERS**

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
Centronics Data Computer Corp. Hudson, NH 03051 (603) 883-0111 CIRCLE 360	122	\$1195	dot matrix	120 cps	11 × 8	3.5-15"	Yes
	352	\$1795	dot matrix	200 cps	7 × 8	4-12"	No
	353	\$2495	dot matrix	200 cps	7 × 8	3-15"	Yes
C. Itch 5301 Beethoven St. Los Angeles, CA 90066 (213) 306-6700 CIRCLE 326	Starwriter F-10	\$2000	daisywheel	40-55 cps	N/A	136 col.	Yes
	Prowriter 8510 1550	\$800 (P) \$850 (S)	dot matrix	120 cps	9 × n	80 col. 136 col.	Yes
Commodore Business Machines 487 Devon Park Dr. Wayne, PA 19087 (215) 687-9750 CIRCLE 327	VIC-1515	\$395	dot matrix	30 cps	7 × 9	3.5-8"	Yes
	4022	\$795	dot matrix	80 cps	7 × 9	up to 8.5"	Yes
	8023	\$995	dot matrix	150 cps	7 × 9	up to 14 7/8"	Yes
	8300-P	\$2295	daisywheel	45 cps	N/A	up to 14 7/8"	No
Dataproducts 6200 Canoga Ave. Woodland Hills, CA 91365 (213) 887-8000 CIRCLE 328	DP-55	N/A	daisywheel	55 cps	N/A	2-15"	Yes
	DP-50	N/A	daisywheel	50 cps	N/A	2-15"	Yes
	M-100	N/A	dot matrix	140 cps	9 × 9	3-16"	Yes
	M-120	N/A	dot matrix	180 cps	7 × 7	3-16"	No
	M-200	N/A	dot matrix	340 cps	7 × 7	3-16"	No
Dataroyal, Inc. 235 Main Dunstable Rd. Nashua, NH 03061 (603) 883-4157 CIRCLE 329	IPS-5000	\$1110 \$1295	dot matrix	125 cps	9 × 9	80 col. 136 col.	No
	IPS-5000P	\$1160 \$1345	dot matrix	150 cps	9 × 9	3-11.5"	No
Datasouth Computer Corp. P.O. Box 240947 Charlotte, NC 28224 (704) 523-8500 CIRCLE 330	DS-180	\$1595	impact dot matrix	180 cps	9 × 7	132 col.	Yes
	630	\$2400	daisywheel	32-40 cps	N/A	16"	Yes
Diablo Systems 26460 Corporation Ave. Hayward, CA 94545 (415) 786-5200 CIRCLE 331	MX 80	\$645	impact dot matrix	80 cps	9 × 9	9-10"	Yes
Epson America 3415 Kashiwa St. Torrance, CA 90505 (213) 539-9140 CIRCLE 332							

SPECIAL REPORT

(continued)
**FEATURES OF
 POPULAR PRINTERS**

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
	MX 80 F/T	\$745	impact dot matrix	80 cps	9 × 9	4-10"	Yes
	MX 100	\$995	impact dot matrix	100 cps	9 × 9	4-15.5"	Yes
Facit Data Products 66 Field Point Rd. Greenwich, CT 06836 (203) 622-9150 CIRCLE 333	4525	\$1595	dot matrix	165 cps	9 × 9	80 col.	No
	4526	\$1697	dot matrix	165 cps	9 × 9	132 col.	No
Florida Data Corp. 600 John Rodes Blvd. Melbourne, FL 32901 (305) 259-4700 CIRCLE 334	120	\$3900	dot matrix	600 cps	64 × 90	198 cpl	Yes
	130	\$4100	dot matrix	100 cps	192 × 360	198 cpl	Yes
Fujitsu America 2945 Oakmead Village Ct. Santa Clara, CA 90505 (408) 727-4300 CIRCLE 335	SP830	check with your local dealer	daisywheel	80 cps	N/A	4-16"	Yes
General Electric G.E. Drive Waynesboro, VA 22980 (703) 949-1000 CIRCLE 336	2030	\$1250	dot matrix	30 cps 60 cps	7 × 9	2.95-15.35"	Yes
	2120	\$2195	dot matrix	120 cps 150 cps	7 × 9	2.95-15.35"	Yes
Heath Company Benton Harbor, MI 49022 (616) 982-3417 CIRCLE 337	WH-14	\$395	dot matrix	75 cps	5 × 7	2.5-9.5"	Yes
	H-25	\$995	dot matrix	150 cps	9 × 9	3.5-17 7/8"	Yes
Infoscribe, Inc. 2720 South Croddy Way Santa Ana, CA 92704 (714) 641-8595 CIRCLE 338	500	\$1595	dot matrix	150 cps	9 × 9	1.5-16"	No
	1000	\$1825	dot matrix	200 cps	7 × 9	1.5-16"	Yes
Innovative Electronics 4714 N.W. 165 St. Miami, FL 33014 (305) 624-1644 CIRCLE 339	202	\$5495	letter-quality	660 cps	N/A	132 col.	No
	154	\$4995	letter-quality	660 cps	N/A	80 col.	No
	250	\$5195	letter-quality	660 cps	N/A	80 col.	No
Integral Data Systems Route 13 Milford, NH 03055 (603) 673-9100 CIRCLE 340	Prism 80	\$999	dot matrix	150-200 cps	.09" high	80 col. 132 col.	Yes
	Prism 132	\$1299	dot matrix	150-200 cps	.09" high	80 col. 132 col.	Yes

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Is it magic? No, not magic, but an amazing software package that generates basic code for programs using your APPLE™ computer.* **THE CREATOR™** by Software Technology for Computers will generate Applesoft BASIC programs in final form in a matter of minutes. No programming knowledge is necessary.

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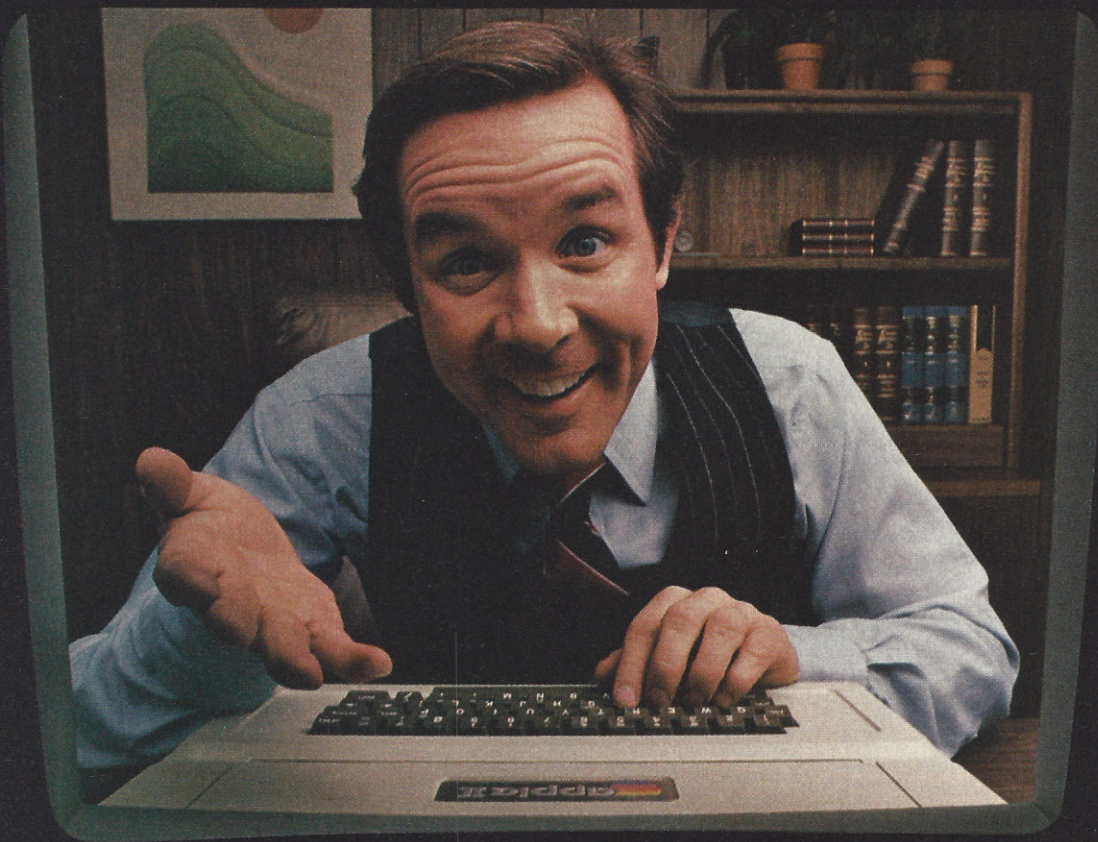
CIRCLE 41

THE CREATOR™ is a trademark of SOFTWARE TECHNOLOGY for COMPUTERS.

SPECIAL REPORT

(continued)
**FEATURES OF
 POPULAR PRINTERS**

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
Kanematsu Goshu USA 333 South Hope St. Los Angeles, CA 90071 (213) 626-1123 CIRCLE 341	Brother HR-1	\$1100	daisywheel	16-20 cps	N/A	16.5"	Yes
Lear Siegler Data Products Div. 714 N. Brookhurst St. Anaheim, CA 92803 (800) 854-3805 (714) 774-1010 CIRCLE 342	310	\$2045	asynchronous ballistic	180 cps	7 × 9	16"	No
MPI 4426 South Century Dr. Salt Lake City, UT 84107 (801) 263-3081 CIRCLE 343	MP-150	\$1095	dot matrix	150 cps	7 × 9 9 × 11	15"	Yes
	88G	\$749	dot matrix	100 cps	7 × 7 7 × 11	9.5"	Yes
	99G	\$799	dot matrix	100 cps	7 × 9 9 × 11	9.5"	Yes
Mannesmann Tally Corp. 8301 South 180 St. Kent, WA 98031 (206) 251-5552 CIRCLE 344	MT 1600	\$1695	dot matrix	200 cps	7 × 9	4-15 1/4"	No
	MT 1800	\$1995	dot matrix	200 cps	7 × 9 40 × 18	4-15 1/4"	No
	MT 3300	\$5495	dot matrix	300 lpm	7 × 7	4-15 1/4"	Yes
	MT 1612	\$2295 (KSR) \$1945 (RO)	dot matrix	200 cps	7 × 9	4-15 1/4"	No
	MT 132	\$3545	dot matrix	200 cps	9 × 9	1.6-15.3"	No
NEC Information Systems 5 Millitia Dr. Lexington, MA 02173 (617) 862-3120 CIRCLE 345	Spinwriter 3500 Series	from \$1995	letter-quality	35 cps	N/A	up to 16"	No
	Spinwriter 7700 Series	from \$2535	letter-quality	55 cps	N/A	up to 16"	No
Okidata 111 Gaither Dr. Mt. Laurel, NJ 08054 (609) 235-2600 CIRCLE 346	ML 80	\$449	dot matrix	80 cps	9 × 7	9.5"	No
	ML 82A	\$649	dot matrix	120 cps	9 × 9	9.5"	Yes
	ML 92	TBA	dot matrix	160 cps	9 × 9 17 × 9 4 × 18 18 × 17	9.5"	Yes
	ML 83A	\$995	dot matrix	120 cps	9 × 9	16"	Yes
	ML 93	TBA	dot matrix	160 cps	9 × 9 17 × 9 9 × 18 18 × 17	16"	Yes
	ML 84	\$1395	dot matrix	200 cps	9 × 9 9 × 18 17 × 13	16"	Yes



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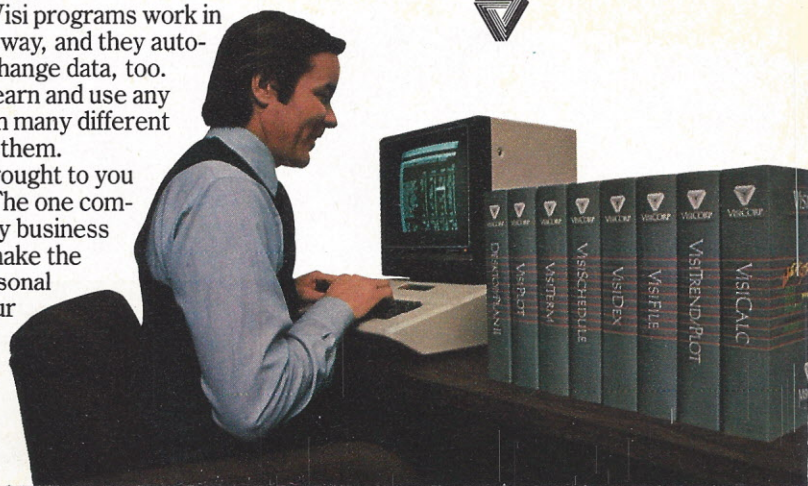
All of the Visi programs work in much the same way, and they automatically interchange data, too. So it's easy to learn and use any of them, work in many different ways with all of them.

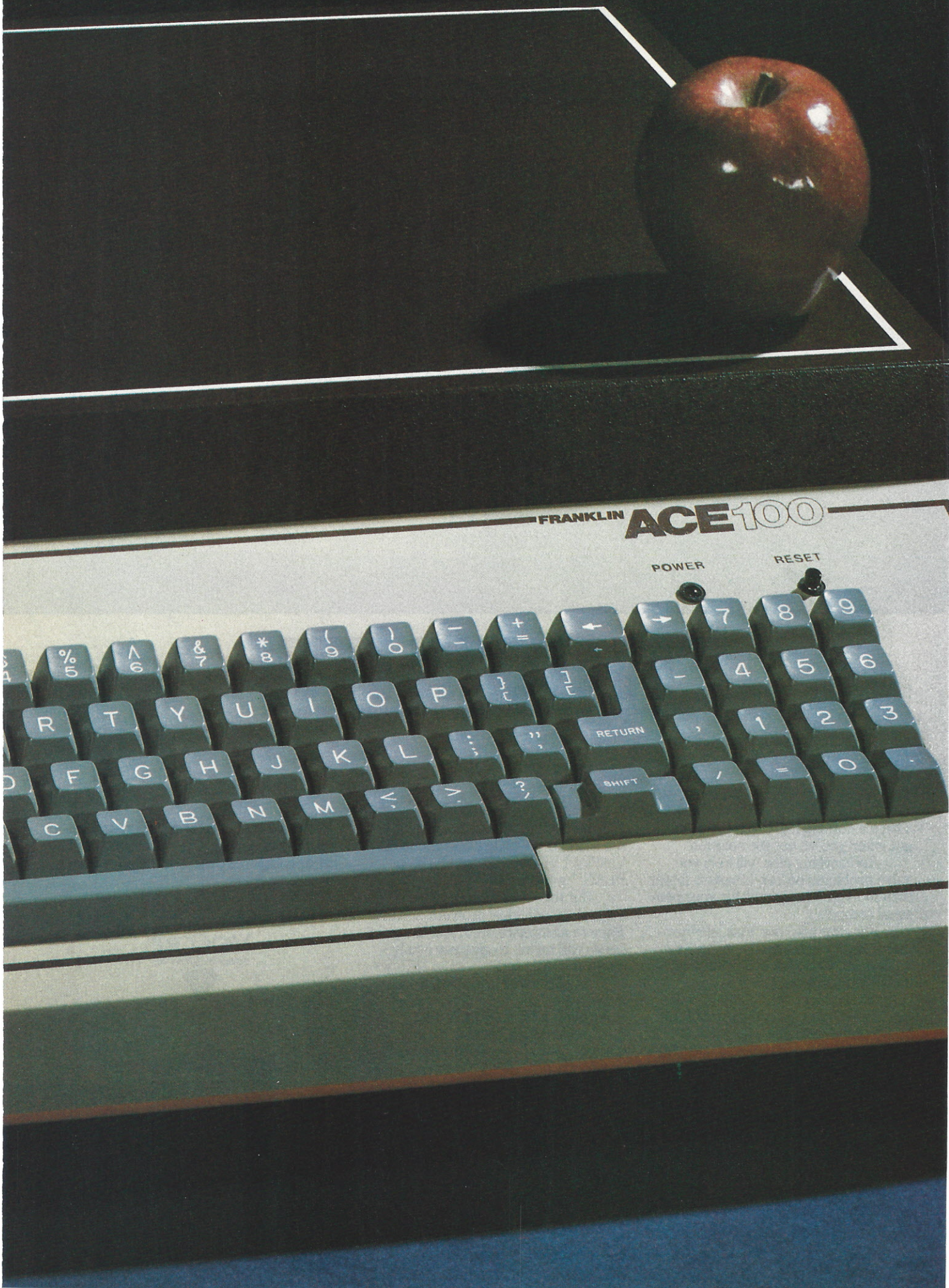
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CIRCLE 72

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Word/Scribe gives you letter quality printing, with 10 or 12 pitch or proportional spacing, at speeds up to 180 CPS; correspondence quality up to 330 CPS; and draft/data processing up to 500 CPS.

For your graphics needs, dot-addressable graphics are provided at up to 144 x 144 dots-per-inch – impressive when you look at the photographs in this ad and realize they were reproduced using 133 line-per-inch screens.

Equally impressive are Word/Scribe's interfaces: RS-232-C Serial and Centronics compatible parallel with a sophisticated communications capability. And for word processing

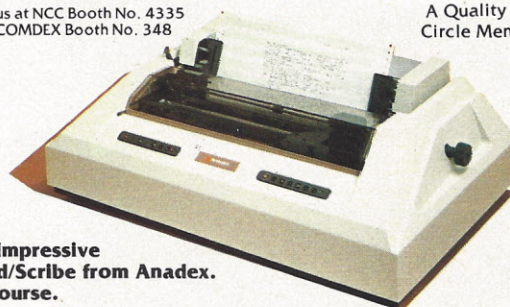
modes, we've added a Diablo 630 emulation package so you can save your software when you update your printers.

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and COMDEX Booth No. 348

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(continued from page 80)

FEATURES OF
POPULAR PRINTERS

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
	2350	\$2550	dot matrix	350 cps	9 × 9	16"	yes
	2410	TBA	dot matrix	350 cps	9 × 9 12 × 9 17 × 15	16"	Yes
Olivetti Peripheral Equipment 505 White Plains Rd. Tarrytown, NY 10591 (914) 631-3000 CIRCLE 347	211	\$1745	daisywheel	20 cps	N/A	up to 17"	No
	311	\$2265	daisywheel	34 cps	N/A	up to 17"	No
Printek, Inc. 1517 Townline Rd. Benton Harbor, MI 49022 (616) 925-3200 CIRCLE 348	910	\$1925	dot matrix	200 cps	9 × 9	up to 16"	Yes
	920	\$2595	dot matrix	340 cps	9 × 9	up to 16"	Yes
Printronix 17421 Derian Ave. Irvine, CA 92713 (714) 549-7700 CIRCLE 349	Taskmaster MVP 2	\$3600	dot matrix	80 lpm 150 lpm 200 lpm	13 × 12 9 × 9 7 × 5	9.5"	Yes
Qantex Division of North Atlantic Industries 60 Plant Ave. Hauppauge, NY 11788 (516) 582-6060 CIRCLE 350	6000	\$1195	impact dot matrix	150 cps	9 × 9	3-15.5"	Yes
	7030	\$1995	impact dot matrix	180 cps 150 cps 75 cps 37 cps	9 × 9	up to 15"	Yes
Quadrum 4357 Park Dr. Norcross, GA 30093 (404) 923-6666 CIRCLE 351	Omni Color 640 I	\$4995	inkjet	4 mpp	12 × 12	14 7/8"	Yes
Qume Corp. 2350 Qume Dr. San Jose, CA 95131 (408) 942-4000 CIRCLE 352	Sprint 7	\$2490 \$2625	daisywheel	45 cps 55 cps	N/A	13"	Yes
	Sprint 8	N/A	daisywheel	35 cps	N/A	13"	Yes
	Sprint 9	\$2660 \$2795	daisywheel	45 cps 55 cps	N/A	13"	Yes
	Sprint 10	\$2270	daisywheel	35 cps	N/A	13"	Yes
	TwinTrack	\$4596	daisywheel	75 cps	N/A	26"	Yes

SPECIAL REPORT

(continued) FEATURES OF POPULAR PRINTERS

COMPANY	MODEL NUMBER	PRICE	TYPE	SPEED	MATRIX SIZE	PAPER WIDTH	GRAPHICS
Radio Shack 1300 One Tandy Center Fort Worth, TX 76102 contact your local Radio Shack store or Computer Center	Line Printer V	\$1860	dot matrix	160 cps	7 × 9	up to 15"	Yes
	Line Printer VI	\$1160	dot matrix	100 cps	7 × 9	4-14 7/8"	Yes
	Line Printer VII	\$399	dot matrix	30 cps	5 × 7	4 1/2-9 1/2"	Yes
	Line Printer VIII	\$7999	dot matrix	40-100 cps	9 × 8	9 1/2"	Yes
Smith-Corona 65 Locust Ave. New Canaan, CT (203) 972-1471 CIRCLE 353	TP-I	\$895	daisywheel	12 cps	N/A	13"	No
Star Micronics 200 Park Ave. New York, NY 10166 (212) 986-6770 CIRCLE 354	DP 8480 Series	from \$575	dot matrix	80 cps	9 × 7 6 × 6 (graphics)	132 col.	Yes
TEI, Inc. 5075 S. Loop East Houston, TX 77033 (713) 738-2300 CIRCLE 355	3431	\$1995	dot matrix	150 cps	9 × 9	8.5 - 14"	No
Texas Instruments Customer Relations P.O. Box 53 Lubbock, TX 79408 (800) 858-4565 CIRCLE 356	PHP-1900	\$399.95	dot matrix	30 cps	5 × 7	32 col.	Yes
Toshiba 2441 Michelle Dr. Tustin, CA 92680 (714) 730-5000 CIRCLE 361	P350 LetterPerfect	under \$3000	dot matrix	160 cps 100 cps	24 × 24	5-15"	Yes
Trilog 17391 Murphy Ave. Irvine, CA 92714 (714) 549-4079 CIRCLE 357	C-100	\$12,800	impact dot matrix	159 cpm	9 × 7	4 - 16"	Yes
Vista Computer Co. 1317 E. Edinger Ave. Santa Ana, CA 92705 (714) 953-0523 CIRCLE 358	MX-80	\$475	dot matrix	80 cps	9 × 9	8.5"	No
	MX-80 F/T	\$599	dot matrix	80 cps	9 × 9	8.5"	Yes
	MX-100	\$799	dot matrix	80 cps	9 × 9	14.5"	Yes
Xerox Corp. Xerox Square Rochester, NY 14644 (716) 427-5400 CIRCLE 359	1730	\$2395	daisywheel	32-40 cps	N/A	16"	Yes

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ANY SYSTEM IS ONLY AS GOOD AS THE BUSINESS PROGRAMS IT RUNS.

The acid test for any business operating system is the application software available to run on it. There's plenty for OASIS—for nearly any job.

And it's top quality, too, because our integrated tools are top quality—and there are more of them. Like a high-level BASIC Interpreter/Compiler/Editor/Debugger; ISAM/Keyed/Direct/Sequential Files; a smart Print Spooler; Automatic Record Locking (OASIS exclusives!); plus COBOL & 'C' Languages. These tools are mandatory for high-quality business application program development—ask any developer. (OASIS exact business fit #2: high-quality application software.)

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OASIS is custom-fitted to manufacturers' hardware so application software developed to run on one OASIS equipped machine can also run on others—and is upwardly compatible from 8-bit OASIS Single-User to Multi-User, on up to OASIS-16. This kind of application software portability is exclusive with OASIS.

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Self Improvement: Beyond Productivity

While increased personal productivity is often the primary goal of computer users, other, more subtle benefits can be accrued as well

by Lee The'

Personal computing is changing people's lives in ways neither makers nor users anticipated. While ads hammer on the theme of increased productivity, there's more than productivity going on when someone sits down at his personal computer. That "what-else" that happens is certain to prove more important, in the long run, than all the obvious advantages of personal computing.

"What else" is simply this: peoples' attitudes change when they use personal computing. They develop a certain flexibility, a willingness to explore, that they didn't have before. And it's only practical because the personal computer brings power into the individual's hands. The power the computer delivers becomes the individual's power, rather than the institution's. This is true even for people working for a large corporation that owns the personal computer. The computer, and the power it delivers, are yours if you directly manage their activities and applications.

People don't talk much about such attitudinal changes. That's understandable, because it's not easy to talk about. It's often much easier to show the quantity of your work increasing, for example, than it is to

demonstrate a quality increase. And it's even harder to talk about the way such a change can carry over into your private life. But it does carry over.

If you've been using computers for a while, you've probably felt this—at least an inkling of it. Maybe you've wondered if others are experiencing this change. They almost certainly

observation to psychological insight. As you do, your understanding of the computer and other aspects of your life upon which the computer impinges, will often improve.

Take me home, country roads

You might use this developing mastery to grow in your present career, or change to another; to work at home or out in the country—while staying firmly in the business/professional community. You could compute in your office, home, both, or while traveling.

But the common thread through it all is the way people improve through using personal-computing technology. Few have succeeded in taking on an important technology without having their lives touched and often transformed. For example, the automobile, to state the obvious, has created a culture of people who view time and space in a radically different way than their ancestors did.

Personal computing is making as radical a change as the automobile did, though it's not yet obvious. What was the impact of the automobile in the first decade of this century, compared to the '30s? But personal computing's consequences are already becoming visible. People are benefiting and changing from their use of personal computing. As they do, the world around them is changing, too.

We'll consider examples from the



are. And they probably find it as hard to discuss as you do.

Many people start out with utilitarian uses for their personal computer—uses such as financial spreadsheet software, word processing, data-base management, graphics, and data communications. (Small businessmen might start with accounting software.) But whatever the point of entry, you might want to modify or create software at some point by programming. After that, it's natural to spread out to software designed to help you grow in every area—from typing to astronomical

A man who monitors the personal-computing industry even while sleeping, Lee The' is our field editor.

“While ads hammer on the theme of increased productivity, there’s more going on when you sit down at your computer.”

major domains of computing: business/professional general-purpose applications like financial modeling and word processing, programming, personal development—like tutorials, serious games and simulations. Running through each area is the excitement technological exploration always brings.

Model building

Virginia Boyd, who manages Barnaby’s English Pub in Bellevue, Wash., uses an electronic-spreadsheet program called Multiplan, published by that town’s Microsoft, to handle her investments at home.

“Once I became familiar with Multiplan,” she says, “I was able to implement my home budget on it. I have learned to use it as a creative financial tool as well. For example, I’m currently involved in buying some real estate. So every time the agent makes me an offer I’m able to run home, plug the figures into my model, and see what the offer really means. It gives me an advantage over the agent with his calculator.”

Boyd started by automating something she was already doing manually. Then she was able to go beyond that and use the software in a way that really augmented her natural abilities. Not that this came effortlessly.

“About a year ago,” she explains, “I was trying to keep my budget on another program, but I had to give up in total frustration. It didn’t explain things to me in plain English. It assumed I was a computer professional. But Multiplan is self-teaching. It anticipates what I’m trying to do. And if I ever get stuck,” she continues, “I just press the ‘?’ key and the program explains the function I’m having trouble with right there on the screen. I don’t feel intimidated by it and I can work out the problems by myself. It makes me feel good,” she concludes.

“It makes me feel good.” People don’t say that about office equipment

like typewriters and copiers. Boyd has perceived that her spreadsheet software has come to affect her life—how she deals with the world, and how she perceives herself. And she believes it has had effects that even go beyond her direct experience with computers. Using Multiplan, she was clearly able to see where the money was going, for the first time. “I realized where I was spending money carelessly,” she claims. And she says



Dot Feldman, co-director of the Family Learning Center, uses word-processing software to organize her work and make more time available for other tasks.

the program has paid for itself in the money she has saved by exercising more control over her expenditures.

The receipt receptacle

She could have done all this without a financial spreadsheet program, without entering all her receipts into the computer each week. The point is that she didn’t before, and she does now. She thinks she’s more productive using this software.

There’s that productivity again. But there’s more than that. While the computer didn’t discipline her, it helped her discipline herself. “I had gained a little bit of weight,” she explains. “After learning self-discipline with that program, I applied it in other areas. I set goals for myself, and priorities.” For Virginia Boyd, the bottom line is more than the sum of monies saved and invested wisely, more than her growing computer literacy. “I see myself as a much stronger person.”

Leon Starr, a Santa Cruz, Calif., instructor, writer and programmer, has similar praise for VisiCorp’s VisiCalc and Sorcim’s SuperCalc, two other spreadsheet programs. “They facilitate the mechanisms necessary to become a good planner,” he claims. And he likes SuperCalc for its help menus.

Starr, like Boyd, had to work to get there. “It took me about a week of heavy use, two to three hours a day, to learn VisiCalc. But now,” he says, “I know that if I have a problem requiring lots of calculations, I have a program that can not only do the computations but change the numbers to project alternatives. And it has made me do things better. I absolutely refuse to let things slip by shodily as I did when I had to use pencil, paper and calculator.”

Has he seen far-reaching changes from his computing? You bet. “The computer,” he maintains, “is a lever for the mind. I don’t worry now about problems that would have stopped me before. It makes me very powerful. I’m a generalist, yet my computer helps me talk to both engineers and artists.”

Dot Feldman is a clinician who is co-director of the Family Learning Center of Evanston, Ill., and South Bend and Elkhart, Ind. She’s a professional communicator who considers herself a good writer. But word processing (with Executive Secretary from SofSys of Minneapolis) was a revelation.

Why does EDU-WARE bother

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Edu-Ware® Decimals illustrate the results of this design process. While the systems share solid instructional principles, their screen displays have been developed to meet their respective conditions of learning. *Fractions* and *Decimals* use color, graphics, and animation to link the mathematical with the concrete. *Algebra* focuses on the logical operations between abstracts.

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Requests for the learner's response are presented in either color or inverse type. The learner has no doubt that he or she is being asked for an answer or to do a task.

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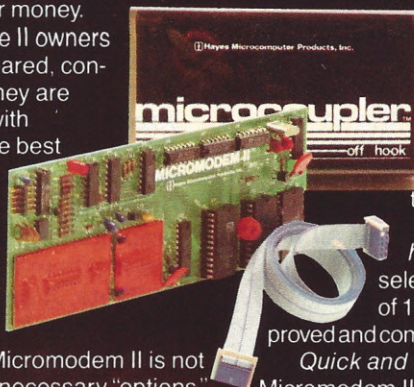
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"The computer, and the power it delivers, are yours if you directly manage their activities and applications."

"It has helped me be more organized," she says. "I use it at home to write material for the workshops I lead." She says she has a lot of material, and she picks different subjects and chunks of material to go into any particular workshop package. It's as if her work were an imaginative version of computerized form letters. "The word processor gives me a huge amount of flexibility, while it helps me organize my work. And it makes time available. Word processing is fun since it lets me do so many things."

Feldman has turned what used to be something of a hassle into a happy exploration of her material, shaping and reshaping it to fit her current needs. "Word processing still enchants me," she enthuses. "If you're used to conventional writing, it's a joy to be able to shift words around so easily. Both creating and editing are enhanced."

Her experience shows there's no age limit on personal computing. She's 55 years old and got her first Apple just over a year ago for home use, with a second one for work about six months later. And she hadn't anticipated any of this happening. Feldman had originally gone into a computer store to get a larger system to run her business with. She got it, all right (an Alpha Micro system with a hard disk). But she also brought home an Apple, and changed her life.

Being legal at home

Word processing changed Marsha Ann Miller-Dowdy's life too, by allowing her to take her legal/secretarial career out of town and into her rural home. She could have done it with a typewriter, but thought she needed a competitive edge to work from a remote location. The low cost of the computer with Wordstar and other software let her get started with limited outside capital. In business since Oct. 1, she's now at the point where she's starting to make money.

The computer has integrated into her life so thoroughly, she has trouble remembering what it was like before. She has been writing a diet book since before she got the Osborne, and she recalls how time consuming all the rewriting was, and what a bother the stacks of manuscript pages were to handle.

Miller-Dowdy has seen people who try to live in the country spend much of their lives in a car, commuting to



David Hughes, a professor at Colorado Technical College, uses *The Source* and his TRS-80 Model III to teach English to students who are telecommuting.

distant jobs. And although she has to work long hours to get her business established, her life has now combined country living and a respectable small-business career—something many dream of and never do. She's done it.

Miller-Dowdy is having it her way. It's not the low road, the easy way. But it's hers, and you can hear quiet pride in her voice as she talks about her firm, Editing Enterprises. A legal

secretary can be as much an individualist as any other company founder.

Beverly Hunter and her husband Hal also run a rural business. Their firm, Targeted Learning Corporation in Amissville, Va., develops software, documentation, training programs, seminars, books, etc. for businesses and institutions. She has Apples and a Commodore in the house, but has come to do her own word processing exclusively with Wordpro on the Commodore CBM because she prefers this particular keyboard and software.

"I have become much more of an artist," she says, "freer and more experimental. I was always a highly structured, technical, dry sort of writer. Now I just sit down and let the writing flow. Then I start polishing it. Writing this way is more natural, and the quality's improved, too."

Psychological help

Hunter is unusually inventive in the ways she uses word processing. She even keeps a calendar on her word processor, which she updates weekly. "It gives me a nice, neat, clean schedule to work with, which helps me psychologically," she notes. She also keeps phone numbers and address lists on the machine. "I don't know if it's actually worth the cost," she says, "but it's helping me manage the information I need to handle."

Boyd, Feldman, Miller-Dowdy, Hunter, all feel differently about themselves. The computer didn't do it for them. They did it, with personal computing.

Word processing, according to Hunter, isn't the only kind of program a writer can use. They need to file and retrieve information, as well.

"I spent two years searching for a very easy-to-use personal filing system," she recalls. "PFS (from Software Publishing, Mountain View, Calif.) was the answer for me. Now I find I can take on more writing assignments because I know that somewhere on disk I can find the research

"I have become much more of an artist, freer and more experimental. I was always a structured, technical writer. Now I just let it flow."

I need. I don't have to dig through boxes of old notes." And of course the ability of data-base programs to systematically search for unorganized data helps. If the data are stored by peoples' names and you're searching for companies, for example, a data-base can really pay off.

Communications software gives one's personal computer giant reach—to independent bulletin boards, to information utilities like The Source, CompuServe and the Dow Jones News Retrieval Service. In so doing, it gives this reach to personal computing's users.

The major information utilities like The Source report that a large part of their revenues come from people who communicate with each other. They read each others' missives, access various bulletin boards, chat directly (via keyboards and screens), and search for ways to communicate that exploit the unique possibilities of CRT's (cathode-ray tube) displays.

The value? For those who are isolated it can be a godsend. The isolation could be geographic or something else. David Hughes, a professor in Colorado who teaches English over The Source, relates a story about one family that has a son with muscular dystrophy. Hughes says the boy was sinking in every way when he discovered The Source, where only the beauty of his mind mattered. The family reports it has saved him, in the most fundamental way.

Roving reporter

Bob Sherman, a veteran photo-journalist from Miami, reports on a colleague of his who has used telecommunications in a way that shows what human ingenuity and computer power can do—both for individuals and for larger causes, in this case, freedom of the press.

Since this man is presently working with a TV network on assignment in El Salvador, his identity can't be revealed. He has an Apple, and he

sits in his hotel room writing his copy on the machine. Then he calls his headquarters on the phone and dumps his data into New York computers before the local censors know what's happening.

This journalist has both scored a personal coup and done a service to the ideal of an informed public. And his circumvention certainly goes beyond simple productivity.

People like Hughes and Sherman believe these information/communications connections are helping people gain personal power, and fostering decentralization, both geographical and personal. When they're accessed by a dumb terminal, Hughes points out, the power is still in the mainframe, and the individual is an appendage. But when the person's own terminal is an intelligent (so to speak) computer, he can juggle the information. He's no longer a somewhat passive recipient of data, but both a user and source in his own right.

Hughes sees a distinct, subtle advantage in this. It's the feeling of having tapped into the master computer with one's own little equalizer. While it hasn't been proved, this advantage may affect one's quality of work with the system. The unproved proposition is this: A person in self-reliant circumstances will feel self-reliant—and the quality of his work will reflect that feeling.

What everyone will agree is that telecommunications has become a source of personal satisfaction, fulfillment, and business productivity. From regional bulletin boards like Sherman's to The Source, people are linking their separate existences into regional and national networks of data access and vigorous interactions. Friendships and intellectual combats are formed and fought. Classes are being taught, poetry is being published. The natural tendency of people to collaborate and help each other achieve personal and social goals is finding outlet here. Telecommuni-

cations may become the most remarkable of all the revolutions taking place under the aegis of "personal computing."

All the applications we've discussed so far had to be programmed by someone. That leads to the natural question, "What are the benefits of programming on my computer?"

Bob Sherman doesn't create programs, but he's learned enough to modify applications packages and games to suit his own particular needs. Kevin Kerr, a high school student in Minneapolis, was able to key in a program listing he found in a book entitled *Executive Computing*. Now he computes the internal rate of return on all the loans his father, a mortgage banker, processes.

But Leon Starr creates programs, and he believes this has a value wholly apart from the utility of the programs thus written. "All the people who work best with computers start out by using them as toys," he opines. "People who start out trying to work applications get a lot of frustrations. I haven't had those frustrations, because I started out with a playful, scientific, artistic attitude. It was much easier.

"Even now when I sit down at a computer I fully intend to make mistakes with 95 percent of what I do on a new system." Starr thinks people learn a lot from those mistakes. "The slowest people aren't slow because they're dumb," he says. "It's because they're either scared or impatient."

But what does Starr feel programming offers, besides the practical benefits of the created programs and the skill itself? "Programming taught me the whole concept of structuring information—of structuring things I didn't know could be structured." Starr found programming taught him general problem-solving skills. When he was confronted with something he couldn't intuitively solve, he could create an algorithm (a sequence of logical steps) to solve it.

(continued on page 134)

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MODE=NORMAL ORDER=R/O ROW=1-50

ROW 1 (Net Sales) <--
ENTER COMMAND:

ROW	First Quarter	Second Quarter	Third Quarter	Fourth Quarter		
1	1,000.0	1,100.0	1,210.0	1,331.0	4,641.0	44
2	450.0	489.5	532.4	579.0	2,050.9	45
3	200.0	220.0	242.0	266.2	928.2	46
4	300.0	350.0	400.0	450.0	1,500.0	47
5	950.0	1,059.5	1,174.4	1,295.2	4,479.1	48
6	50.0	40.5	35.6	35.8	161.9	49
7	5.0	3.7	2.9	2.7	3.5	50
8	0.0	0.0	0.0	0.0	0.0	51
9	0.0	0.0	0.0	0.0	0.0	52
10	45.0	44.5	44.0	43.5	0.0	53
11	0.0	0.0	0.0	0.0	0.0	54
12	0.0	0.0	0.0	0.0	0.0	55
13	0.0	0.0	0.0	0.0	0.0	56
14	0.0	0.0	0.0	0.0	0.0	57
15	0.0	0.0	0.0	0.0	0.0	58
16	0.0	0.0	0.0	0.0	0.0	59
17	0.0	0.0	0.0	0.0	0.0	

1 Net Sales
2 Cost of Good
3 Gen & Admin
4 Res & Develo
5 Total Costs
6 Gross Profit
7 % Profit
8
9
10 % C.O.G.S.
11
12
13
14
15
16
17

44 INVERSE
45 INVERSE
46 INVERSE
47 INTEGER
48 ROUND
49 CUMULATE
50 ABSOLUTE
51 ADD K
52 SUB K
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57 ZERO
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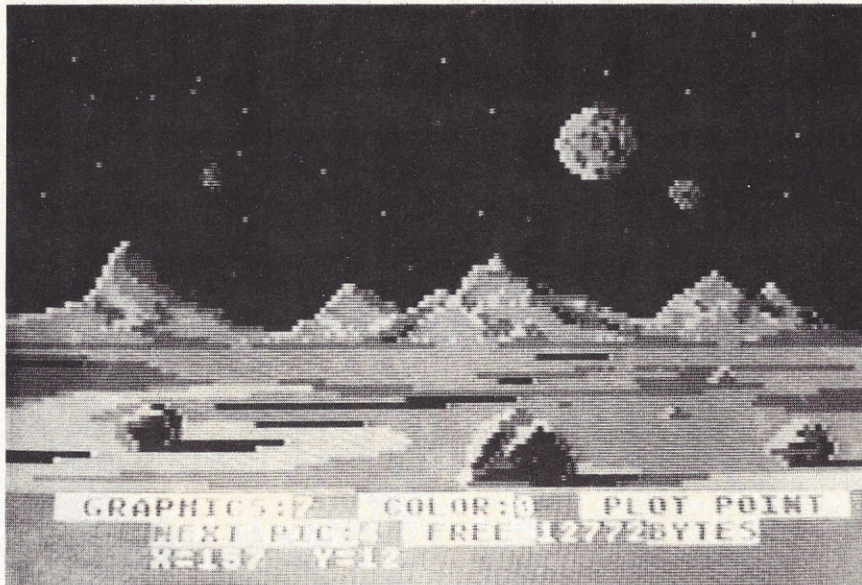
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Scene from BETA FIGHTER during creation using the DRAWPIC graphics editor.

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POKER TOURNEY: by Edward Grau (Atari 32K, Northstar)
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Operating Systems Under The Microscope

A new operating system can open up a maze of previously inaccessible software, but some questions must first be answered

by Bernard Falcoff

Personal-computer users have been dealing with operating systems (OS)—programs that were once strictly the province of programmers and system designers—for about seven years now. CP/M, the best known, indeed has a large base of compatible application software, simply because it has been around so long. But whether you *need* to buy CP/M, or any operating system other than the one your hardware manufacturer provides, can be decided by analyzing the problem you're trying to solve. If, for example, you only want to run a data-base management program or a spreadsheet program on an Apple or a TRS-80, you don't need an operating system other than the one the hardware manufacturer provides. On the other hand, if you're going to run a large, sophisticated business application, you may need another OS, but a choice must be made as to which one.

It was in 1975 that Gary Kildall, president of Digital Research Inc. in Pacific Grove, Calif., developed CP/M. The first disk-based 8-bit operating system, it was marketed for about a year through word-of-mouth promotion and mail-order outlets to a growing market of personal-computer users. Since there was no other operating system available for personal computers, CP/M filled a distinct need. As Kildall says, "It was a low-cost operating system

that didn't try to do everything."

But hobbyists and engineers decided to make the most of CP/M. In fact, they designed so many application programs that run under CP/M, and they developed so much hardware, firmware or software that is compatible with CP/M, that it is now seen by many personal-computing companies as a universal operating system.

Despite its popularity, though, it isn't the only operating system available for personal computers. And it has some drawbacks that are causing many users to switch to newer, more sophisticated systems.

The nuts and bolts

Just what is an operating system? Essentially it's a program that comprises a set of rules and procedures that manage the way a computer works. As the basic program for the computer, the operating system coordinates the hardware, sets out the terms for how the application software is to be written, and serves as a kind of interface for the user. It may be written in any language, from the 1s and 0s of machine language to the intermediate-level assembly language to a high-level language like BASIC or Pascal.

A disk, or disk-based, operating system is one that comes on a disk. These operating systems can be much more extensive than those stored in ROM or on tape, because of the larger storage area available to such programs.

Jim Handy, product marketing

manager of the Operating Systems Division of Digital Research, explains an operating system this way: "When you use a computer," he says, "you use two systems. The first is the application program, which does the actual task. The second is the operating system, a program that irons out the differences between various pieces of hardware."

"Let's say one manufacturer sells a computer that doesn't have an attached terminal," he continues, "while a second manufacturer sells a machine that has the monitor and keyboard built in. Both machines use the 8080 microprocessor. Since one requires a cable connection between the terminal and the keyboard and the other doesn't, the machines are very different at the hardware level. But they are very similar at the logic level, because both machines use the same microprocessor. That processor issues a command to put a character on the screen, and it doesn't care where the screen is. The operating system is the entity that gets that command from the processor and reconciles the differences at the hardware level."

The bottom line

What this means in practical terms is that if an individual purchases an Altos computer and the person in the next office has a Heath computer, the Altos owner needs a CP/M operating system configured for that computer, whereas the Heath owner requires a CP/M specifically for his machine. Both machines will then be able to

Bernard Falcoff was recently appointed documentation editor for Commodore computers.

"CP/M has some unfriendliness built into it, but that's changing now for the man in the street."

use the same application programs usually with only minor modifications and sometimes even with none.

It sounds simple. Substitute the CP/M operating system for the one that came with your computer (assuming it was different) and open up the door to a whole new world of application programs. Unfortunately, it's not as simple as it sounds.

For one thing, you talk to CP/M in a whole new operating system language that isn't particularly easy to learn. Because the system was developed early in the history of personal computing, when hobbyists held sway, its syntax is fairly complicated. Furthermore, the language is computer-oriented, not business-oriented. But probably the biggest problem with CP/M is its manual. "There are a lot of people making a lot of money off the complexity of our manual," says Handy. "We weren't really worried about it, because traditionally our market has been hardware manufacturers and programmers."

But as more people enter the market who are interested in using the personal computer as a tool, rather than as an end in itself, this hard-to-use operating system is being seen as something of a problem. As a result, two different approaches have been followed. First, some companies are developing "add-ons" for CP/M that make the system easier on the user. Second, new operating systems are now on the scene that get around many of CP/M's problems.

Not too difficult

James Gates, president of Williams Construction Company in Columbus, Ga., recently purchased a TRS-80 Microcomputer Model II. "I bought my computer for word processing, stock-market tracking and critical-path scheduling," he says. "I'm just now learning to program in BASIC, but I've already found that CP/M is better for me than TRS/DOS [the operating system that comes with the

TRS-80]. CP/M's universality was the major reason I went with it. I don't really think it's too difficult to use, but it is staggering at first with its 20-pound manual. Of course, it helps that I have a friend who's an application programmer who helps me. And I'm waiting for my CP+ [an add-on program for CP/M], which is supposed to give you a menu so it's easier to enter data."

Gates's construction company handles quite a few military construction jobs (Fort Benning, the Army Infantry School, is located near Columbus) and is currently using an outside computer firm to meet certain government requirements. He hopes that his use of CP/M, and particularly CP+, will allow him to bring those government-required activities in house.

CP+ is one of many enhancements that have been developed to make CP/M easier for today's user who may not have the patience to learn CP/M's syntax. John Simpson, author of CP+ and the president of Taurus Systems (San Francisco, Calif.), the company that markets the program for \$150, explains: "CP+ provides the nontechnical user of CP/M with a whole different way to communicate with CP/M-based systems. It replaces all the complicated CP/M commands with normal English commands."

"What usually happens is this," Simpson continues. "The person who first buys the system learns it and then passes on the knowledge to the other employees in the company. All of a sudden, other employees must learn to use the computer. At this point, one of two things can happen: Either the rest of the employees learn CP/M, or everything gets done by the resident expert. But what happens if the expert leaves? The company is in real trouble until it finds a replacement."

Simpson says the other side of the coin is equally tough. If the boss says he wants everyone to learn to use

the computer, people often get "computer fright" and start making mistakes. With CP/M, he says, that can be fatal. Critical files, for example, can get erased by mistake. In fact people have erased complete disks with CP/M, according to Simpson, when they didn't intend to. The net result is that a few people, the "experts," are the ones who wind up operating the equipment, because CP/M doesn't provide user protection.

In addition, Simpson says, "CP/M is not updated for the market that exists now. Therefore, there is a whole generation of unfriendliness built into it. It's about time that changes for the man in the street."

A teaching system

Another way around CP/M is a CP/M tutorial system, called Teach-M, from Select Information Systems (Kentfield, Calif.). Its author, Zev Rattet, executive vice president of Select, says, "The problem with CP/M is that it's too complete. The manual gives you so much information that you don't know what you need to use an application program. It wasn't until we put our product on the market that we realized just how little anybody, including the dealers, knows about disk operating systems. Basically, you want to know how to boot disks, copy disks, create new disks, make backup copies, move files around and create new files. Teach-M is performance-based instruction that tells you how to do that."

Teach-M begins with its own definition of an operating system. "An operating system is much like an office manager. Office managers set up filing systems, organize and reorganize them, move them around, and give us information from and about them." This definition is very different from Jim Handy's, which was strictly hardware-oriented. It shows that people are thinking of operating systems as more than mere peripherals managers.



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"When people ask what operating system is best, they're asking the wrong question. They should first ask about application software."

At this point it is important to note two aspects of CP/M. First, it is a single-user/single-task operating system. Second, it operates on 8080, Z80 or 8085 8-bit microprocessors. So if you own an Apple II Plus, you don't have CP/M, because it uses a 6502 microprocessor. Instead you have one of two operating systems. The first, which comes with all Apple IIs, could be called the BASIC operating system. It understands certain system commands and, of course, lets you program in BASIC and run those programs. When you add a disk drive to the Apple II you also get Apple DOS, an expanded operating system that, among other things, handles the disk drives for the computer.

If you want CP/M on the Apple, don't despair. There are some very popular add-on cards for the Apple that make CP/M a reality for that machine. Specifically, the Softcard from Microsoft (Bellevue, Wash.) among others, which is available from your local dealer and provides a Z80 microprocessor and the necessary peripheral circuits to enable your Apple to run CP/M.

Industry figures show that about 20 percent of all Apples have a Z80 card installed. In addition to adding the processor to run CP/M, most of the cards also provide extra memory to make up for the amount that CP/M requires (about 7k). Most manufacturers recommend at least 64k for operating in the CP/M environment.

What about other operating systems? Are there advantages to going to another? Or are you almost required to use CP/M if you want to use good business applications software?

Of course not. Besides the proprietary operating systems that come with personal computers from many hardware vendors, there are ones available from software houses, and many of them have real advantages when they are compared with CP/M.

Michael Heck, manager of sales promotion for Commodore Business Machines (Wayne, Pa.) cites one example. "CP/M is a hog on disk space," he says. "Commodore DOS uses intelligent disk drives that incorporate firmware [programs in ROM] containing the DOS commands. So you can access the disks right out of BASIC."

That's only one feature, but there are others. For example, CP/M is, as previously mentioned, a single-user, single-task operating system. Therefore, if the computer is running a printer, all other operations have to halt until the print task is completed. In a very small business environment, that isn't a problem. But as more people in a company learn to use the computer, the company is faced with two choices: Make the computer do more than one thing at a time or get more computers. The latter choice may be too expensive.

So, to meet the expanded needs of business users, Digital Research has complemented CP/M with other systems: CP/M-86 and MP/M. The first runs on the 8086 microprocessor, one of the 16-bit processors. The second runs on the same processors as does CP/M, but allows for multiuser operation.

There are also other advanced operating systems. Among them are Unix, from Bell Labs; Idris, from Whitesmiths Ltd. (New York, N.Y.); Oasis, from Phase One Systems (Oakland, Calif.); and MS DOS, from Microsoft (Bellevue, Wash.), which is the operating system supplied on the IBM Personal Computer.

Who needs it?

What kind of business user needs an advanced operating system? One such person is Ted Rosen, executive vice president of Raymond Rosen and Company, a wholesale distributor of consumer electronics, appliances, and floor coverings in Philadelphia. The company services

29 counties in and around the Delaware valley.

Rosen had been using CP/M on the computer in his home but recently switched to Oasis. "I had hardly even heard of it," says Rosen. "But a customer of mine was looking at this operating system that Don Feith [of Feith Systems and Software, an Oasis distributor] wanted to sell him. At the same time I was looking for a personal computer for the office.

"We went to Oasis," says Rosen, "because we thought it had a lot more to offer than CP/M. I have total flexibility in Oasis, I write my own programs, and the BASIC is much more powerful. For example, the length of variables is over 200 characters; I never have a character file name that is too long for Oasis. It also has automatic indent capabilities and multiline IF statements, and it provides for multiuser operation and password protection.

"There's only one drawback to Oasis—there is a limited number of application programs. That is not to say that there aren't programs available. Through Phase One, you get a book with about 500 programs that work on Oasis, and you're put on the mailing list for program-list updates.

Why is Oasis so different from CP/M? Howard Sidorsky, president of Phase One Systems, explains it this way, "Oasis was created from a different environment than that of CP/M. It comes from the typical minicomputer environment, which includes things like long-on, password, etc. We wanted to create the personality of a typical time-sharing system with such program tools as ISAM [Indexed Sequential-Access Method] and keyed file types, which provide more efficient data storage. That in turn improves application programs."

Sidorsky believes that "people should not really buy an operating system. When they ask what system is best, they're not really asking the right question. What they should be

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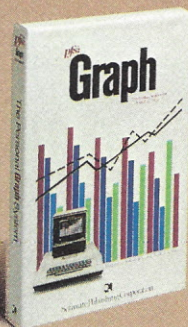
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asking is, 'Where can I find the application software to solve my particular problem?' As people move their computers into multiuser systems, more things are required of the system: items like backups, passwords, planning, limiting access—all the things people need in a more professional environment.

"A lot of people who were pushing their CP/M systems to the maximum found that it got to be more work than it was worth. Some of them found Oasis."

The filing system

The major difference between Oasis and CP/M is the file structure. Oasis is based on a hierarchical file structure. That means you can access a file, and then any file in that file, and any file in the next file, and so on. CP/M has a single-level file structure. The advantage of a hierarchical structure is that you don't have to go through all the files to find a particular file, because, just like a file cabinet, CP/M stores things at different levels. The disadvantage is that if a system "glitch" occurs, it is usually next to impossible to retrieve all but the first-level files. To solve this problem for Oasis, Feith Systems and Software did a study on how to mess up an operating system and then wrote assembly-language routines to prevent system errors or to fix them if they occur.

Don Feith explains: "What is a business system? Basically it's lots of files. In an average business, it could be 40 to 50,000 files. When a glitch happens, the files are still there. You just can't get to them. But Oasis can. It compares old program codes with new codes and matches each with its proper location."


Oasis is based on an older mini-computer-oriented operating system called Unix. Unix was developed at Bell Laboratories by Ken Thompson and Dennis Ritchie. It requires a 16-bit processor and 128k of RAM. CP/M doesn't really consider itself

in competition with Unix, but CP/M-86 and MP/M-II could be considered as part of the high-end market.

Unix is described by Demetri Rotow, product manager for Fortune Systems, a company that bundles Unix for distribution. "I learned Unix at Harvard," says Rotow. "Everywhere else there was deliberate obfuscation. There was no attempt to open Unix, because it's so user-friendly that people would realize that system programmers wouldn't be needed. Everything in Unix looks like a file, and you can run any file to any file—for example, electronic mail, spelling correction, addition checkers, etc."

There are many Unix variations, and their numbers will increase as more 16-bit computers arrive on the scene, since Unix works well on those machines.

One Unix variant is Cromix, from Cromemco in Mountain View, Calif. Designed for use on that company's computers, Cromix differs from Unix in its master data record lock that maintains data integrity. It also has built-in instructions, and fewer commands than Unix, which is a boon to users. But at the same time it has added features, like a print spooler. According to marketing manager Chris Rook, the print spooler allows unlimited cueing and lets as many as six printers operate at one time.

Many users list a print spooler as a high-priority item. It allows the computer to cue a number of print jobs destined for one, or more, printers. Ted Rosen explains the ease of using the Oasis spooler this way: "With CP/M, which doesn't have spooling, I have to use separate disks to print files on dot-matrix or letter-quality printers. With Oasis, I can generate class codes that are stored in a separate file. I then write a print program that doesn't care what print codes are used, since they are picked up from the separate file with an attach command." 

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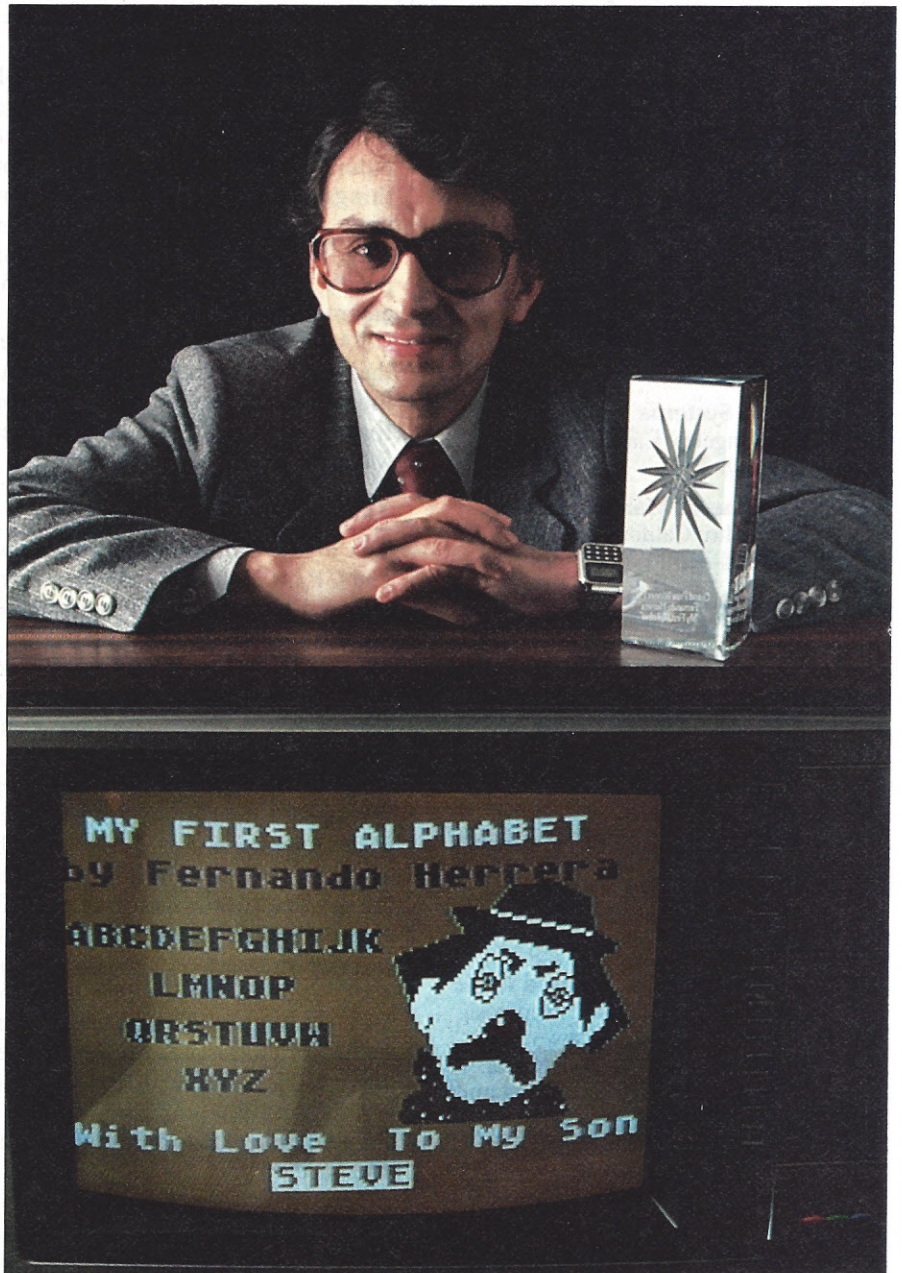
Fernando Herrera became the first grand prize winner of the ATARI Software Acquisition Program (ASAP) competition because he believed in computers, his son and himself.

The story of Herrera's success began with his son's sight problems. Young Steve Herrera had been born with severe cataracts in both eyes and, naturally, his father was concerned. Herrera reasoned that the boy's learning abilities could be seriously affected by growing up in a world he could not see.

Having just purchased an ATARI 800 Home Computer, it occurred to Herrera that this could be the perfect tool for testing Steve's vision. So he wrote a program simply displaying the letter "E" in various sizes.

Success! It turned out that 2-year-old Steve could see even the smaller "E's" without special lenses. Herrera was first relieved, and then intrigued when he discovered that not only could his son see the "E's," but he would happily play with the computer-generated letters for hours. So Herrera added a picture of an elephant to go with the "E," and then more letters and pictures. Thus, "My First Alphabet" was born, a unique teaching program for children two-years and older consisting of 36 high resolution pictures of letters and numbers.

Herrera submitted the program to the ATARI Program Exchange, where it became an instant best-seller. ATARI was so impressed with the outstanding design, suitability and graphic appeal of "My First Alphabet," that the program is being incorporated into the ATARI line of software.



In addition to his grand prize winnings of \$25,000 in cash and an ATARI STAR trophy, Herrera also automatically receives royalties from sales of his program through the ATARI Program Exchange.

But Fernando Herrera wasn't the only software "star" that ATARI discovered. Three other ATARI STARS were awarded at the ASAP awards ceremony for software submitted to the ATARI Program Exchange and

judged by ATARI to be particularly unique and outstanding.

Ron and Lynn Marcuse of Freehold, New Jersey, teamed up to write three winning entries in the Business and Professional category for home computers: "Data Management System," "The Diskette Librarian" and "The Weekly Planner."

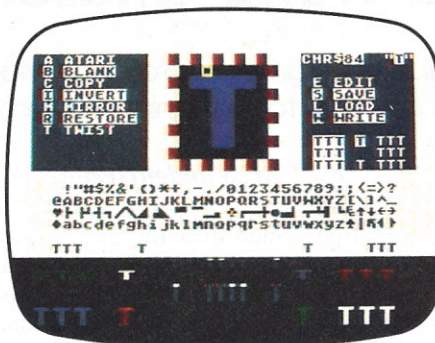
Sheldon Leeman of Oak Park, Michigan, captured an ATARI STAR for his exceptionally well-engineered "INSTEDIT" character set editor.

Greg Christensen of Anaheim, California, became our youngest ATARI STAR winner at the age of 17. Christensen designed the clever "Caverns of Mars" game program, which also will be incorporated into the ATARI product line. Greg designed the program in 1½ months after owning his ATARI Home Computer for less than a year.

Every three months, ATARI awards ATARI STARS to the writers of software programs submitted to the ATARI Software Acquisition Program and judged first, second and third place in the following categories: Consumer (including entertainment, personal interest and development); Education; Business and Professional programs for the home (personal finance and record keeping); and System Software.

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Fernando Herrera had a great idea that made him a star. ATARI would like to give you the same opportunity.



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A/D Software Eases Real-World Challenges

Simple analog-to-digital programs provide innovative answers to perennial problems

by T.M. VandenHeede

Editor's note: In Personal Computing last month, the mysteries and intricacies of analog-to-digital conversion were unraveled—what it is, how it works, and what it means to the personal-computer user. This month, we offer specific examples of the types of analog-to-digital software that are available and how the programs are being used.

Albeit with mixed results, taming the real world has been a preoc-

Dr. T.M. VandenHeede is a physicist and design engineer who works for a computer manufacturing firm.

cupation of man since the club he was carrying burst into flames and warmed the air around him. This taming is, of course, still going on, and, over the years, man has employed a wide array of tools to assist him in his efforts. In many ways, the personal computer is the latest tool in a long line of hard-working handmaidens.

And recently it has been put to some unusual tasks:

- Ronald Paganelli, in the fruit farm country of Washington State, has hooked his Apple II to a temperature-measurement device and placed heat-sensitive probes into the ground of his

pear orchard. The computer constantly monitors the temperature and warns Paganelli of the coming of frost.

- In Minneapolis, Bradley Robinson is tracking the temperature of different parts of his house with his personal computer and a temperature-measurement board. Thanks to this set-up, tied into his passive solar-heating system, his heating bill—even in the cold Minnesota winter—has come to zero so far this year.

- Jean Peschke of Dayton, Ohio, has eschewed some old horse-and-buggy teaching methods and is using a music-synthesizer board and her personal computer to teach her students music.

These three examples are just a small sample of what can be—and already is being—done with “addon” cards that significantly expand the domain of the personal computer. These cards contain circuitry that converts the electrical signals of the real world into signals that can be understood and manipulated by the computer. The former are called analog signals; the latter, digital signals; and the circuitry, an analog-to-digital, or A/D, converter.

By converting analog signals into digital form, these cards allow data to be sent directly to the computer, rather than having to be entered through a keyboard, joystick, or some other means. And often, they contain circuitry that enables the computer to respond in kind to the real-world signals. That is, they also house a digital-to-analog, or D/A, converter.



Jeanne Peschke has hooked a synthesizer to an Apple II and planned music courses around them.

“Analog-to-digital add-on cards significantly expand the domain of the personal computer.”

Some of the most interesting things going on with personal computers revolve around the phenomena of A/D and D/A conversions. The possibility of having a home computer create electronic-house science fiction has come closer to reality in the past few years. Users are showing a great deal of interest in the peripheral add-ons and hardware enhancements for the personal computer, and many have the imagination and skill to use them for fun and profit.

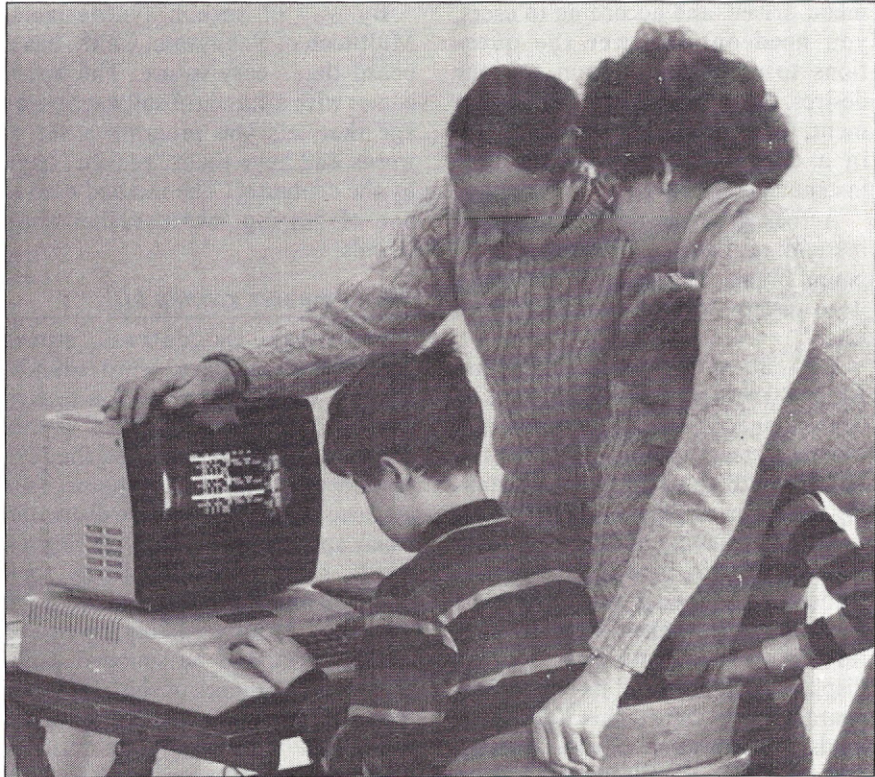
Among the most enticing entries in the field of personal-computer peripherals since 1979 are music synthesizers, speech synthesizers and other such boards. What makes these boards especially inviting is the fact that most of the software that makes them run is easy to use; the work has been done by the manufacturer. As a result, personal-computer users can have the fun and the advantages they offer without being “computer nuts” or programming whizzes.

Making music

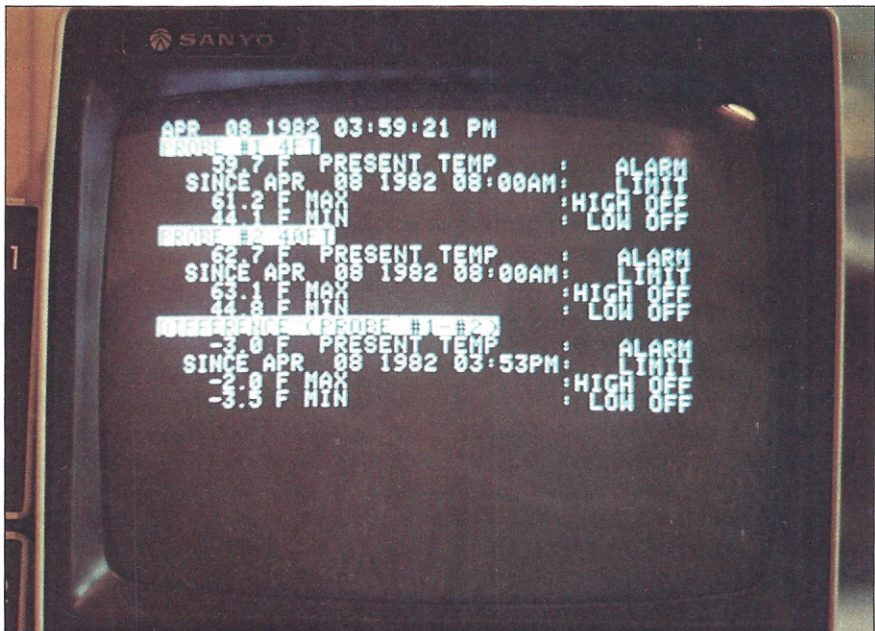
One company keeping a high-profile these days is Syntauri, purveyors of synthesized music. Operating out of a home in Palo Alto, Calif., the firm produces a synthesizer board called the Alpha.

The Alpha Syntauri is a system that includes the board to plug into an Apple, and a keyboard. There are foot pedals, software amplifiers and speakers. With this package you can create your own music using several techniques. You can sound like eight different instruments—all at the same time, if you wish. You can harmonize with yourself or go solo. You can devise ways of instructing others (or yourself) to learn keyboard playing. There is even a software package just released that lets you design your own music by drawing line patterns that the synthesizer converts into sounds.

The software included is “self-contained.” That is, there is no complex reprogramming to be done. It is



The Robinsons at their Apple “monitoring stations” where A/D software controls their home’s climate.



The monitor displaying temperature variations on Chris Paganelli's Washington state fruit orchard.

menu-driven, and according to users, you need only answer the questions to adapt the system to your desires. To select a particular instrument, for example, you need only key in a character representing that instrument.

A rock group is using the system instead of hauling around a 400-pound organ. The group is also using it to create "visual" concerts with lasers.

But one of the more interesting Alpha owners is Jeanne Peschke, who has one rigged to her home Apple and uses it to teach music. She uses the Suzuki method, a technique of teaching children to play keyboards first by ear, by listening to tapes and such. The big problem is to try to keep the student from looking at his fingers as a crutch. What makes Alpha so helpful is its excellent color show, one that displays each note and its octave in a characteristic color. This light show holds the attention of the student, and keeps his eyes from straying to his hands.

Peschke is very excited about all the possibilities for music making on the Alpha. She has produced music recitals for her students that have received rave reviews. And she feels that the Alpha is a top-notch educational device, and "it is one of the best classical music training tools around. It has the ability to reproduce 30 different instruments," she says, "and when a student learns, say, a piece by Bach, he has the chance to play it on the Alpha to see what it sounds like on a harpsichord or a clavichord."

When asked how hard it was to program her lessons and her concerts, she replied, "I'm really a musician, not a computer person, and I will say that it represented a whole new way of thinking about music. I didn't have any trouble with the instructions or the software from Syntauri. I was able to follow the directions to get the right results even though I didn't know why it happened."

By way of speech synthesizers, Multitech of Sunnyvale, Calif., has a board that's easy to use. The board comes with a standard software package that lets you program a set of words and have them "spoken" back by the computer. The method used is one of storing words rather than sounds.

The computer sounds off

The Votrax, in contrast, stores "phonemes" or basic word sounds. When a word is typed in, it is broken into its rudimentary sets of letters and letter combinations, and they are "sounded" out by the computer. This approach does lead to some distortion when spelling a number of English words, since we do not really spell phonetically. For example, the word "through" would probably have to be spelled "thru" to be sounded properly. The advantage of this method is that you can have something of an unlimited vocabulary by putting together sounds to form any English word. Because Multitech's approach is to store whole words rather than sounds, it ensures very accurate word reproduction. The vocabulary however, is limited to the number of words you have room to store.

Multitech's board plugs into the Apple interface card—slot 2 is preferred, but any spare slot is acceptable. The directions are easy, the software is in BASIC, and the software is simple to follow. What's more, the user is supplied with many example learning programs and a few demonstration programs.

John Bell Engineering in San Carlos, Calif., also has several speech synthesis and A/D-D/A boards for Apples. Most of the time, people use them for playing and hobbies, but one of Bell's customers purchased both the A/D and the speech board. The application involved using the A/D board to monitor conditions in a power plant, and the speech board was programmed to speak instructions when a problem arose.

It is a simple matter to attach the speech board to the Apple. The card fits into slot 4, and there is one wire that goes from the board to an 8-ohm speaker. Then, on the Apple screen, the user runs the Catalog, which gives him a menu of sample programs. If these do not fill the bill, the user can change them as desired and think up new programs of his own. The maximum orientation time is less than an hour.

The company's A/D-D/A boards are designed to be used with any computer that has a parallel input/output port. It also interfaces with a second card for easy plug-in to the Apple II computer. The one channel A/D and D/A converter was originally intended for experiments with digitally recorded speech, but it can also be used to synthesize music and has many other applications in the laboratory, at work and at home.

A handy gadget

The Strawberry Tree in Sunnyvale, Calif., has a handy little gadget called a Dual Thermometer. This is a board and software for measuring temperature, and some of the most interesting applications are being done with this package.

The Dual Thermometer is designed to plug into the Apple II. It can store temperature data and time on a disk at intervals specified by the user. Later the information can be recalled and printed. An alarm can be set to any limit chosen, and it is also possible to tailor your screen display to your own liking.

The board comes with two 10-foot probes for temperature monitoring, and will display the temperature difference between the probes. The software will support up to seven Dual Thermometer cards—14 probes total. You can read temperature in degrees Fahrenheit, Celsius or Kelvin, and the display can be in either a 12- or 24-hour clock. Data can be stored on a disk or printed at intervals you choose, from once every 10 minutes

"The computer constantly monitors the temperature and warns of the coming of frost."

A CHEMICAL CASE HISTORY

On a tree-studded campus nestled in the wealthy Chicago North Shore suburbs, a young chemistry professor is using a unique, home-made analog-to-digital computer system to take the drudgery out of advanced chemistry instruction. This application, he feels, could have significant meaning in commercial laboratories.

When teaching chemistry, Assistant Professor Larry Shoer of Lake Forest College says, the idea is to give students data to manipulate and learn from. "Yet," he says, "students spend much of their time collecting data, not learning from the data. I felt there had to be a better way than teaching serious chemistry students how to heat ovens, turn knobs and read dials. In the real world, that's the domain of the technician, not the chemist."

The obvious answer, says Shoer, was to add a personal computer. "My starting premise," he says, "was that we could use a computer to store all kinds of data, compiled under a variety of conditions, present it to the students, and say, 'Here are the results of your instruments' work. What do they mean?' That's what teaching chemistry is all about."

Shoer says that while large industrial companies can buy highly specialized—and expensive—computer equipment that interfaces with chemical laboratory instruments, there are many small labs and educational facilities that cannot justify the high costs of such equipment, "especially when it may become obsolete in two or three years."

For schools and private labs, Shoer says, the personal computer is the answer. After receiving his doctorate from Princeton in 1978, Shoer went on to post-doctorate studies in computer applications at the University of Illinois. In the course of his work at Lake Forest, Shoer had access to a North Star Horizon personal computer. The university has six such machines in its computer science department.

"The problem with interfacing laboratory instruments and personal computers," Shoer says, "is that they are

different beasts. Computers deal with digital signals; most laboratory instruments deal with analog signals. A gas chromatograph, for example, takes a complex sample of a substance and breaks it down into its component parts, and then outputs its analog results to a strip chart recorder or to a needle on a scale. Someone has to look at the chart or read the dials and make judgments."

A computer could have a library of standards, plus other functions, to do that kind of judgment work. The problem Shoer says, is making the analog instruments talk to the digital computer, and receiving a final output that can be manipulated. After some trial and error, Shoer arrived at the college's present set-up, which is being used successfully in the chemistry department.

To get the system in working order, an amplifier was needed to boost the lab instruments' signals. "Typically, a lab instrument puts out a signal in the one to 10 millivolt range," Shoer says, "while an analog-to-digital converter works with signals in the one to 10 volt range." Shoer's answer was to simply build an amplifier "for less than \$50."

With the North Star Horizon, a high-end personal computer designed for scientific and business applications, Shoer selected a Vector Graphic analog-to-digital 12-bit converter board which dropped right into the computer's S-100 bus. Keyboard input and print output are then handled by an enhanced DECWriter II with graphics capabilities. All components are mounted in a wheeled rack "so we can take the whole system to the instrument." For software development, a CRT was added to the system, "but it isn't necessary for the instrumental analysis," Shoer states.

The system was completed with software written by Shoer in North Star BASIC. The program for the gas chromatograph is less than 20k long, Shoer says, adding, "and that's heavily remarked, with one statement to a line. It could be considerably shorter." Further, the program is a turnkey system, which means that there are no boots,

loads, and runs to get in the way of the student's use of its capabilities. "We're teaching chemistry," Shoer states, "not computing."

The program combines, evaluates and prints out the data as a highly refined peak-and-valley chart, accompanied by alphanumeric indications of just what the peaks and valleys show. Built into the program are various ways to manipulate the data to achieve different results and compare them, or to access a variety of data and compare what the differences in the gathering of those data mean to its evaluation. A leading Midwestern forensic and industrial chemist studied print outputs of Shoer's A/D gas chromatograph system and offered to market it on the spot.

As Shoer says, "The computer is a laboratory instrument, just as mass spectrometers or X-ray fluorescence machines are lab instruments. There are only two constraints, both of which seem to be solvable. First, there's the question of cost. Personal computers are solving that, as prices come down and computing power goes up.

"Second, there's the uneasiness with which many people approach a computer. A chemist wants to be a chemist; he doesn't want to be a computer expert, and he shouldn't have to be. When the computer becomes as friendly as a television set, that second constraint will also be conquered. And personal computers will find their way into almost all labs, raising the creativity and efficiency of the chemists working there."

Analog-to-digital conversion is part of the exotica of personal computing. Using it is not as commonplace as booting up VisiCalc or Apple Pie, but in its still limited applications, it stretches the definition of personal computing. Initially, at least, A/D software will be a heavily relied upon research and scientific tool. After that ground is broken, though, many of the scientific applications—such as voice recognition, robotics and speech synthesis—are expected to naturally find their way into the business and home use, and become part of the common technology.

***“Having a home computer
create electronic-house science
fiction has come closer to
reality in the past few years.”***

to once a year. The program is written in Applesoft BASIC, and it is easily customized.

Help for the farmer

The Dual Thermometer is at work monitoring the temperature in chicken coops. A vineyard in California uses it for frost warnings, and people are also using it to help dry macaroni and to make chocolate.

Take Ronald Paganelli, the farmer who runs the orchard in Washington State. About two months ago, he purchased a Dual Thermometer board for his Apple II. His immediate need was for a frost-warning and control system, so he rigged one of the two probes at a height of four feet and the other one at 40 feet. Monitoring the difference in temperature at these two levels can detect an inversion—when the temperature at the upper probe is warmer than that of the lower probe. If a particular lower probe temperature is maintained for a certain period of time, damage will occur to the crop. So when this point is reached, Paganelli can turn on his wind machines that circulate the warmer upper air down onto the trees.

Paganelli makes no claims to being a “software person,” but he does have big plans for future projects with his Apple and the Dual Thermometer. He plans to add pear-protection to his blight-prevention scheme. There is a formula—a combination of temperature, time and humidity—that allows him to determine when conditions are such that the blight mold will grow on the pears. His Apple and Dual Thermometer will read these conditions and set off an alarm to tell him it's time to spray. This exact determination will maximize the effect of his spraying and prevent any unnecessary spraying. According to Paganelli, the thermometer is accurate to within a half of a degree Fahrenheit.

He was somewhat uncertain at first if this package would fill the bill.

“I had seen other boards from computer catalogs and it turned out that the packages were not very complex, and they were also not very accurate.” He now seems more than satisfied. In fact, he's one of the package's most enthusiastic advocates. When asked how difficult this “complex” Dual Thermometer package was to implement, he replied, “From the box to working order it took an hour. And it took me that long because I had to string it through the bushes, rig the second probe to my fishing pole, and then mount it on top of a 40-foot power pole. If you just throw 'em out the window, it'd take 10 minutes.”

Overall, he is delighted with his package. “The Strawberry people have done the best software job. They have made implementation a snap. If there's anything I want to do to change things, they are always very helpful and offer suggestions. A very good 70-page manual is included, and it's full of examples of different applications.”

Computers, timing and chocolate

Terry Richardson is a researcher at a food research company in Hayward, Calif. He is also using the Dual Thermometer with his Apple, but he uses it to test the proper temperatures of chocolate. “There is an optimum time in the cooling cycle to use chocolate,” he explains. “We can keep records of the temperatures of various tests.”

Richardson has some programming knowledge, but his main job is that of food researcher, and he was very happy to have the standard software package supplied with the board. “So far I've had no need to modify the software. It has been very satisfactory.” As for the measurements, “At first there was a concern that the probes were not sensitive enough,” he says, “but it seems that there has been an improvement since the original. Future research will tell.”

Richardson has much more research to do, and the experiments

with the use of the temperature board are still in progress.


Bradley Robinson, unlike Richardson, admits to being a computer novice. When he built his house in Minneapolis, it was one of four super-insulated homes in the state. He has his Apple II Plus, a Dual Thermometer card, and about 30 thermocouples throughout the house to monitor temperatures and heat loss through walls and floors. His intention was to check on the job his passive solar heating system was doing.

Not a computer nut

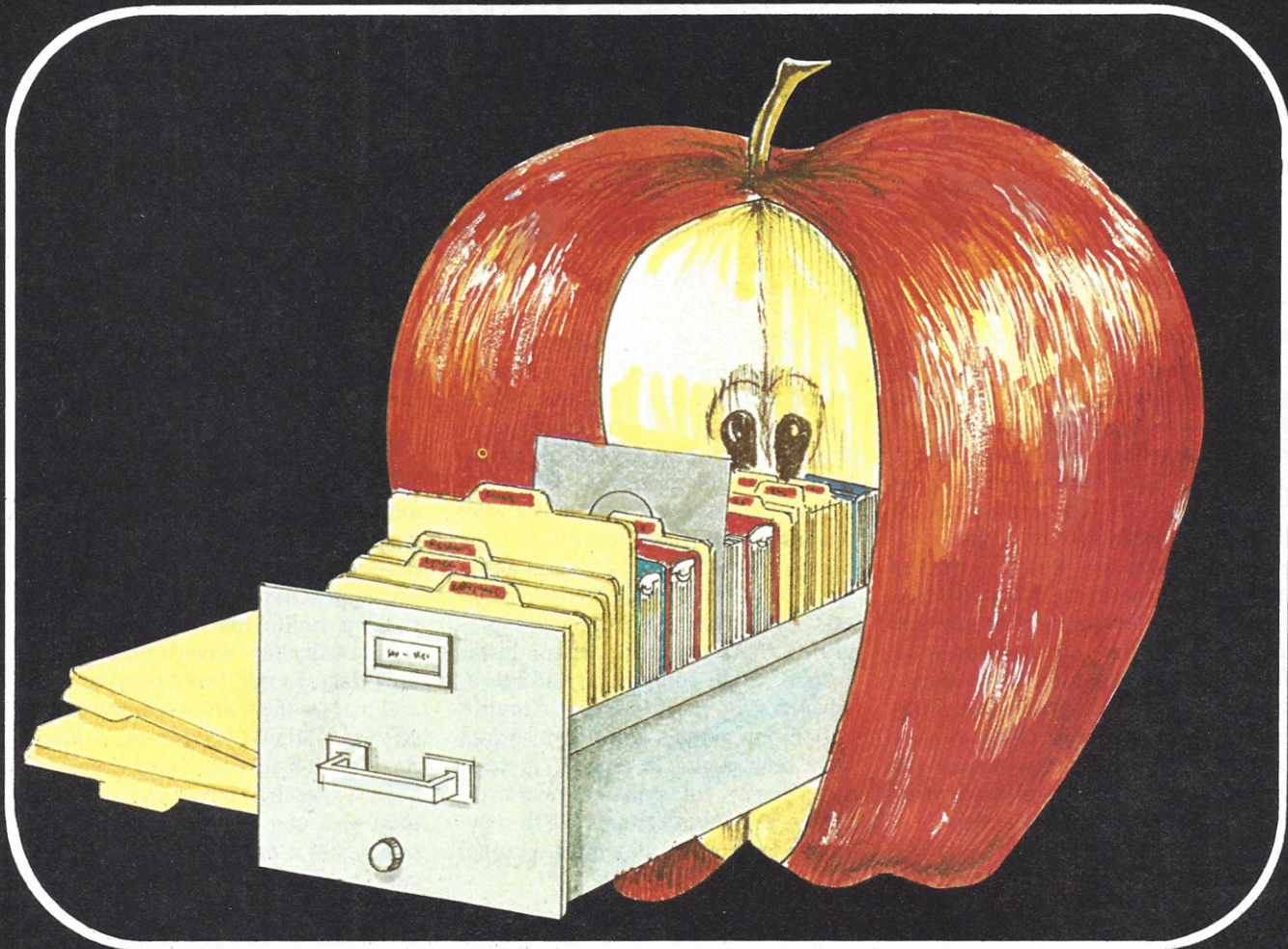
Robinson uses the original software, and had no trouble mounting the diskette and following the directions on the screen. Now his plans are growing rapidly. “I'm far from being a computer nut,” he says, “but I'd like to get more cards and probes to monitor my air-to-air heat exchanger.”

“For me to make it work, it's got to be simple,” he says. “I've had good luck with the system. The only additional thing I had to do was splice one of the probe wires and add in about 100 more feet of lamp cord. There was no problem with the extra length. It is still very accurate.”

“Very good instructions come with the system,” he continues. “You just pop the top, plug in the board and wrap the wires. It's all very easy. The kids haven't wrecked it, and neither have I. It's a great little board.”

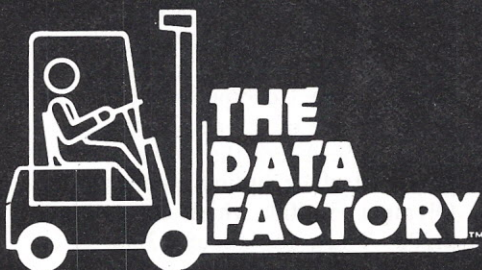
Robinson has looked around at the many peripheral gadgets and pieces of equipment available for monitoring and controlling homes. The Apple with a Dual Temperature card is a great conservation measure, he notes, and he is surprised that at present so few people have turned to their personal computer to reduce the amount of the utility bills. In his case, he has paid nothing to heat his house so far this year. He hopes to continue the trend—with the aid of his Apple II and the A/D-D/A conversion technique. 

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Computers Pave The Campaign Trail

As people from all professions jump on the personal-computer bandwagon, far be it from politicians to be left standing on grass roots

by Judah Hill

The use of computers in the political arena in recent years has grown tremendously. For example, the nationwide, computerized mass-mail fund raising and proselytizing operations have been given a lot of attention, as has the partisan use of large data processors to design rival reapportionment plans. And, of course, the traditional election night has been in the spotlight as well, as each network flogs its machine to be first with the correct forecast. Meanwhile, back at the grassroots, computers are quietly beginning to play an expanding (and sometimes controversial) role in the actual day-to-day work of campaigning for votes.

Down at the district/ward/precinct level, where ballots are won word-by-word, door-by-door, and meeting-by-meeting, the word-processing and data-base applications of personal computers are developing into potent political tools. In the 1980 elections many candidates hired professional computer contractors. These firms, equipped with a minicomputer or large micro system, ranged in services offered from the basic handling of simple mailing lists to full-scale political consultants.

But today . . .

This year's elections will see an even greater use of such services. Many organizations and campaign staffs are discovering that personal

computers—Apples, Osbornes, and TRS-80s—can perform valuable functions and provide capabilities which, as a practical matter of access and cost, are best served by an in-house personal computer.

Initially, personal computers were brought into electoral politics by computer hobbyists/campaign activists who sought to link their two interests by developing applicable programs. With the rapid decline in the costs of small computers, and recent advances in programming simplification, individuals and organizations have now begun to acquire systems specifically for political work. In most cases, these systems are first put to word processing or simple mailing-list tasks.

Campaign trail word processing

The primary ingredient of any election campaign is the word, particularly the written word: position papers, brochures, speeches, newsletters, flyers, fund-raising letters, thank-you notes. All of this material must be written, edited, and produced as quickly as possible amidst the hectic activity of a busy campaign. Computerized text editing allows the writer to add, alter, or delete words, sentences, or entire paragraphs at will, and then print out the final copy in the desired form. By eliminating the redundant typing of successive drafts, and using the text formatter to automatically handle such time consuming and costly typesetting layout chores as justified margins, columns, heads, pagination, and

so forth, an organization can save an enormous amount of money—and labor.

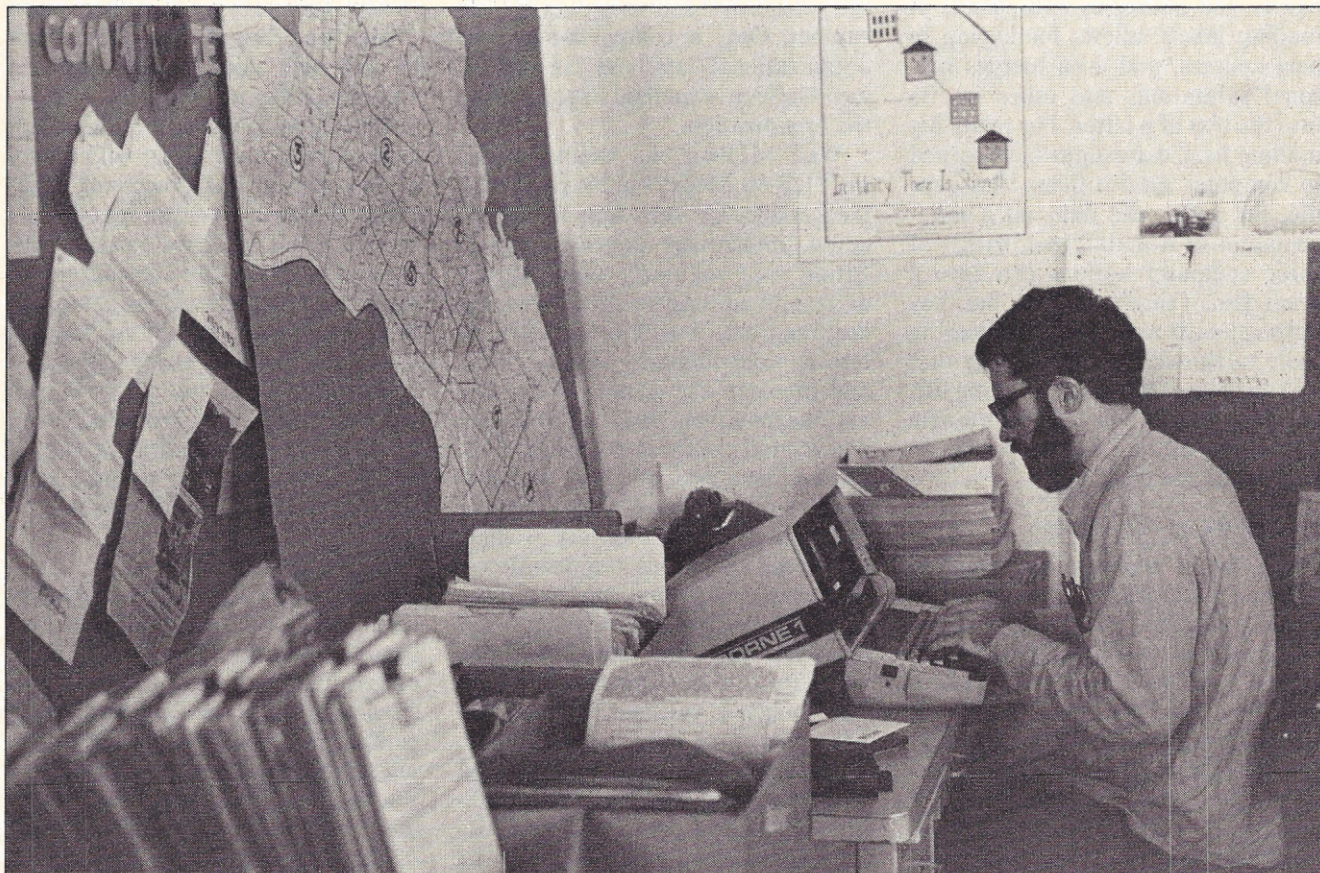
Get some sleep

When it's one o'clock in the morning and the text of tomorrow's press release is definitely approved, word processing means you can get a few precious hours of sleep before facing (with a smile) the cold rubber pancakes of the next dawn's fund-raising breakfast. In addition to saving wear and tear on the staff, word processing efficiency allows for greater political flexibility. If fast-changing events require a speech to be revised at the last minute, it can be done with the computer, and a printout of the new text can be obtained—triple spaced, and underlined. The formal transcript for the media is then prepared, in just a little more time than it takes to key in the changes.

Even a small campaign can afford this capability. The Osborne 1 personal computer, for example, which comes already equipped with Wordstar (one of the better personal computer word-processing programs), lists for \$1800. Not only is the Osborne inexpensive, it is portable and can be set up anywhere—a living room, a campaign bus, a hotel room or even, backstage at a meeting hall—to give on-the-spot service. Like many personal computers, it can be linked to one of the new model electronic typewriters that have a computer interface option, such as the Olympia ES-100, which costs about \$1200. Thus, for about \$3000 it is

Judah Hill lives in the San Francisco Bay area and watches computerized political campaigns closely.

"When it's one o'clock in the morning, word processing means you can get some sleep before the a.m. fund raiser."



The Oakland, California, Rent Control Board found the Osborne 1 to be invaluable in putting together the text of their proposed rent control law.

possible to obtain a basic letter-quality word-processing system.

An aid in rent control

Mark Goldowitz, an attorney with the Oakland Rent Control Committee in California, is enthusiastic about his Osborne, and found it invaluable in putting together the precise text of their proposed rent control law. "It's great," he says. "You can have a monster meeting with 20, 30 or 40 changes, and the next day you have a clean fresh draft."

Of course, like most people who have never used a computer, Goldowitz had the typical new user problems, particularly with inadequate documentation. "By now," he says, "through trial and error, I've become fairly proficient at using the word-

processing system. The documentation provided was not very good for people who hadn't done word processing before. I had to buy several different publications so that if I couldn't find an answer in the official manual I could find it in another. You shouldn't have to do that." Yet in spite of this difficulty, within a week of part-time use Goldowitz was using the program for campaign activity; within a month it had become familiar.

The mailing list has always been the bane of every campaign staff: boxes and boxes of alphabetized 3 by 5 cards, each with name, address and other data, each needing to be copied onto an envelope for every mailing. Through the years every organization has had to contend with this unwieldy

mass in the best way that technology and the pocketbook would allow. A common scene was big rooms with long tables and hundreds of volunteers busily handwriting addresses, clanking machines with little ink stained address plates that smear the envelopes and jam the works, sheets of adhesive labels that have to be typed hour after hour, and the Xerox duplicates that had to be updated one by one before the next mailing.

It is this paper blob that first moves most groups to seek the aid of a computer. It is relatively easy for even a small computer to take over the task of printing out and maintaining a simple, small mailing list. Wordstar, for example, comes with an option called Mailmerge that does this reasonably well. It rapidly prints out

names and addresses onto sheets of mailing labels, allows for keying in new updates, and even merges personal salutations and other inserts into the text of a letter. For really big mailing lists, campaigns have turned to computer service firms that handle, for a fee, the data on a mini-computer or a mainframe. Either of these computer options can save a great deal of time and labor, but they both whet the appetite for something more sophisticated, something that will go beyond the simple mailing list, something that will help coordinate the organization. In other words, an organizational data base.

The heart of the matter

At its heart, every political organization is a list of names—people who have contributed time, money, resources or political support, or people who have at least indicated that they have an active interest in the campaign or in some particular issue. The problem is that these people are buried within the general mailing list, which is usually compiled over a period of time from many varied haphazard sources: friends, allied organizations, former supporters, contributors, petition signers, inquirers or even attendees. Unless the active supporters can be efficiently identified and mobilized, there is really no organization at all. And unless those people with particular interests or concerns can be precisely pinpointed, the only way to keep them informed is to constantly use expensive shotgun mass mailings to everyone on the entire list—mailings which not only drain the treasury, but overwhelm the patience of the average recipient.

Tracking, updating and sorting the various contributions and concerns from the amorphous, miscellaneous mass of the general list is a difficult, labor intensive task traditionally not solved by little notations on 3 by 5 cards, colored file tabs, pushrod and paperpunch sort systems, or lots of

special lists lost somewhere in the file cabinet. Only a computer-managed organizational data base can provide a cost-effective method of organizing the organization.

Walt Milliken, for example, uses his TRS-80 Model I in his work with the Berkeley Citizens Action—an ongoing, multi-issue political organization that regularly fields candidates and runs issue campaigns. By keeping track of each individual's interests, contributions, support work and precinct, the group can quickly and inexpensively direct information and requests to those people most interested and most likely to respond. This ability to speedily sort through the mailing list by a variety of characteristics gives this organization a tremendous flexibility and strength. If money must be raised fast, a list of former contributors and their phone numbers can be printed out. If the city council is considering a specific issue, letters or calls can be sent to those who have indicated an interest in that subject. When precinct walkers are needed, all of the canvassers from past elections can be recontacted.

As Milliken states, "It means that for the same amount of money as other campaigns you can make much more efficient use of the people and resources you have. The advantage of computerized phone banking and direct mailings is that you target your message rather than send one general city-wide mailing."

The ideal data base

An ideal organizational data base, for example, might track such information as name, address, ZIP code, precinct, phone number, occupation or business, language preference, marital status, school-age children, own/rent, particular issue interests, history of financial contributions, and specific activities taken part in (such as a particular event attended, petition circulated, committee worked on, etc.). It might also track

various generic types of support given (walking a precinct, allowing home to be used for a block meeting, working a phone bank and so on).

Clearly, keeping track of this much data requires a computer with plenty of data storage and processing capability. Milliken, whose range of information is not as broad as the above example, allots 100 characters of memory per person; 50 for name, address, phone, etc; and 50 for interest and activity codes. Using Apparat's NEWDOS-80 on his TRS-80 with two 8-inch and two 5-inch disk drives, he is currently handling a list of about 5000 names, but he could go as high as 10,000 with this system.

Available options

Instead of setting up an organizational data base on an in-house personal computer, some campaigns choose to hire an outside firm for this purpose, such as the Pete McCloskey campaign for U.S. Senate in California's Republican primary. This group is using the Los Altos Research Center (LARC) in California for much of its computer services (data base, word processing, analysis and so on). Using a Hewlett-Packard 3000 minicomputer, LARC offers a broad-spectrum program called the Campaign Roster System, which is capable of handling a great deal of data on a very large number of names. The basic fee for this is 20 cents per name, per month, with most of the data entry labor assumed by the campaign staff (for 25 cents per name LARC will do the labor).

There are three major considerations when a political organization chooses between an outside computer service and an in-house personal computer: capacity, cost and programming. Compared to a minicomputer such as LARC's HP-3000, which can handle several hundred thousand names if necessary, the organizational data base capacity of a personal computer is more limited. The number of names a small com-

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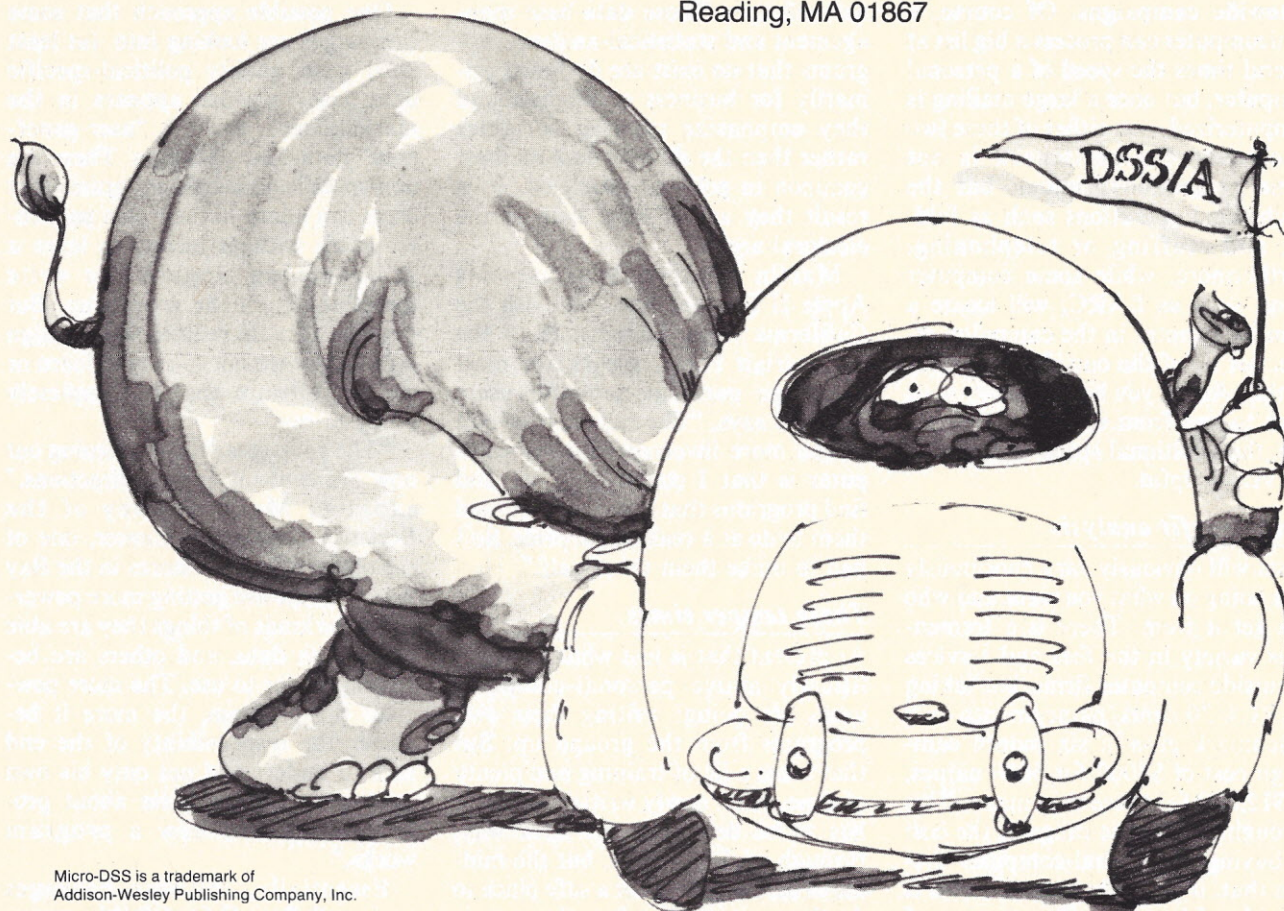
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"A survey can become a worthless ritual when it is used to merely confirm what experienced people already know."

puter can process without swapping data-storage disks varies widely depending on the particular system configuration, the amount of information stored per name, and the specific program being used. But a rough estimate might be somewhere on the order of one name for every 200 to 300 characters of disk storage memory. Thus, a typical personal computer, such as the Osborne 1, Apple II Plus, or TRS-80 or Model III, would range roughly from 1000 to 5000 names.

This number could be significantly raised, however, by adding supplemental disk drives, or spending \$2000 to \$4000 for a multimegabyte hard-disk memory unit. A 5 megabyte hard disk, for instance, could probably handle all but the very largest of statewide campaigns. Of course, a minicomputer can process a big list at several times the speed of a personal computer, but once a large mailing is computerized—on either of these two machines—the bottleneck is not name generation/printout, but the mechanical operations such as folding and stuffing or telephoning. Furthermore, while some computer firms, such as LARC, will locate a terminal/printer in the campaign office, not all of the outside companies do this. And if you have to carry your work to and from someone else's office, the additional speed of a mini is not very helpful.

Cost/benefit analysis

Costs will obviously vary enormously depending on what you want and who you get it from. There is a tremendous variety in the fees and services of outside computer firms, but taking LARC's 20 cents/name/month as a benchmark gives a six month campaign cost of \$6000 for 5000 names, or \$12,000 for twice that many. This is roughly the same range as the cost of buying a personal-computer system that, if properly programmed, is capable of handling that amount of data. And for really large lists (25,000 names) that would cost

\$5000 each month with an outside firm; an in-house personal computer with a hard-disk memory unit can do the job for significantly less money then six to nine months of service fees. And, of course, once the in-house system is paid for, it is available on a permanent basis for only the small operating costs. So in the case of an on-going political organization (or organizer), the real cost of a personal-computer system, spread over time, is far less than hiring an outside service.

The political program

At this time the major obstacle preventing the widespread use of personal computers for campaign purposes is the lack of readily available, easy to use software. Those data-base management and statistical-analysis programs that do exist are designed primarily for business or science, and they emphasize running variables rather than the discreet factors most common in political problems. As a result they are of little help in the electoral arena.

Martin Beurger, who uses his Apple II Plus for his work with the California State Committee of the Libertarian Party, speaks for most campaign personal-computer users when he says, "The reason I haven't gotten more involved with my computer is that I couldn't go out and find programs that did what I wanted them to do at a reasonable price. So I had to make them up myself."

Those temper times

At present that is just what most politically active personal-computer users are doing: writing their own programs from the ground up. But that takes a lot of training and plenty of time. Also, newly written software has to be debugged the hard way, through trial and error, but the middle of an election is not a safe place to do that, especially when the race is close, the hours long, tempers short, and patience thin. You simply cannot

risk losing vital data or crashing the system during the heat of a campaign. It is difficult enough to learn the correct procedure for running a pre-tested program without having to brave the errors, catastrophes and subtle tricks that so often lurk in untried software.

Even during the calmest of times, testing and learning can have its political costs. "People are very unforgiving when computers are not accurate," says Beurger. "For example, the poor guy who moves, and lets you know he's changed his address, expects the information to be put on the system. And it is. But then someone else comes back later with the old address and changes it back again. We've had that problem."

One possible approach that some campaigns are looking into (at least until good quality political-specific data-base software appears in the marketplace), are the "user-generated" data-base packages. These are non-specific data-base programs that users can adapt to their own particular needs without having to learn a programming language or write something from the ground up. But because they do require some design input, they are not so easy to learn or use as software that is completely ready to run.

"The packages that are coming out now are evolving in two directions," explains Marv Downey of the Berkeley Computing Center, one of the oldest computer stores in the Bay Area. "Some are getting more powerful in the kinds of things they are able to do with data, and others are becoming easier to use. The more powerful the program, the more it becomes the responsibility of the end user to understand not only his own application, but a little about programming and how a program works."

Essentially, software packages such as D Base II for CP/M systems or D.B. Master for Apples are master programs that are used to generate

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various utility disks or sub-programs. These sub-programs are then used to process the data. Thus, one master program could be used to develop many different specific political applications such as an organizational data base, survey results, precinct analysis and so forth. But to accomplish this requires some study and experience. Downey estimates that it will take at least 20 to 40 hours of learning and experimentation before someone can expect to begin producing any useful results at all.

"We encourage people," says Downey, "when they buy the more difficult programs, to have somebody on staff who has the time and energy to become an expert on the system they are going to be using. Usually, at a location where there are more than five people, there's going to be one person who, of his own accord, falls into the role naturally."

Computers and political strategy

A more controversial use of computers is in the development of campaign strategy. Computers are being used more and more in the effort to develop a constellation of political positions that best represents the needs and perceptions of the electorate. Computers are also being used to devise the most effective method of reaching the voters with the limited human and financial resources of the organization. Since politics is an arena of conflict, it comes as no surprise that the use of data processors in campaign decision making is a matter of wide differences of opinion. These disagreements range from the technicalities of data collection and interpretation to fundamental differences of political principle.

Examining attitudes

Before formulating a position on rent control, for example, a candidate for city council would certainly wish to examine the numbers and attitudes of the apartment dwellers and property owners in his ward. He is, after all,

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supposed to be a representative of his constituents. On the other hand, a candidate who parrots only what the public opinion polls indicate that the majority wish to hear is rightfully criticized for a dangerous lack of principle, and justly suspected of fraud.

Whatever the overall political outlook of an organization, computer data processing can help provide the facts on which strategies are based and then implemented. For example, computer analysis of the various precincts' past voting records and turnouts, opinion surveys factored by political attitudes and demographics, application of census data to precincts—these are all techniques that can provide valuable evidence from which to draw conclusions, and carry out the plan. But gathering data and decision making are not the same, and no machine can provide a substitute for human judgment.

The high-school civics class ideal of a democracy is that all of the candidates and issues are presented, in full, to the voters who then make an informed choice. But no candidate has the time, no organization the money, and no staff the people, to reach—on a comprehensive, detailed, or person-to-person basis—anything more than a fraction of the electorate. It was not possible to do this in the city assemblies of ancient Greece, and it is not possible in modern districts of hundreds of thousands of voters. Thus, what reaches the average voter from a campaign is, at best, a limited collage of images, endorsements, summaries, slogans and symbols.

The tactical decisions about how and where to allocate and deploy the ideological, human and financial resources of a campaign are constant, complicated, and usually hotly disputed. Computer-generated data can provide some of the raw material on which these judgments are based.

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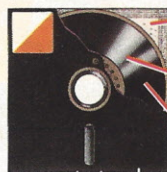
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differences in approach. Walt Milliken of the BCA, for example, uses his TRS-80 to develop statistical tools such as "precinct indexes of persuadability," based on the premise that in the early stages of a campaign it is most productive to concentrate on those areas where large numbers of voters are undecided or open to argument. One indication of this, according to Milliken, is the degree of variance in previous elections between the number of votes cast for the different BCA-sponsored resolutions or candidates. In other words, he looks for precincts that in the past voted strongly for some candidates but not for others, thus proving that they are open to some BCA positions but not already committed to the entire slate.

Harvesting votes

Another kind of tool he develops is an "index of productivity." In the later stages of a campaign the organization wants to concentrate efforts on mobilizing the solid supporters and getting them to the polls on election day. By measuring past turnouts and results with current surveys and demographics, precincts can then be prioritized as to the number of votes likely to be harvested in the final weeks of activity."

Martin Gorfinkel of LARC, however, is critical of how some computers have been used to influence campaign strategy. "Decision making," he says, "can be hidden under a computer, and frequently is. But basically the computer can't make any decisions for you. As you go about making decisions or preparing a strategy there are two aspects to what you do. One is formulating the questions and putting together the logic. That has to be done by a person."

The other is the mechanical things that don't take human intelligence, such as sorting things or correcting drafts.

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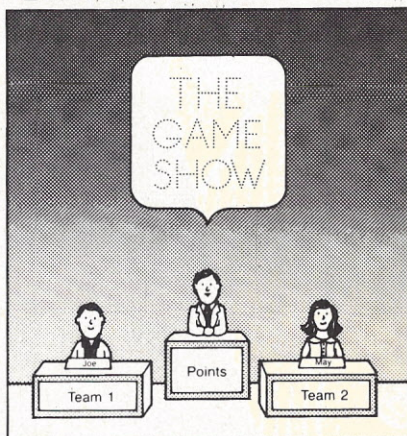
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by computer rather than by hand."

Given certain assumptions and criteria, a computer can help organize and generate information, but it is the human-supplied logic which is the key, not computer processing. Given adequate data, a computer can help answer questions, but if the assumptions are wrong or the question is off the mark, what the computer will produce will be worse than useless. This is why Gorfinkel stresses the dominance of human knowledge and expertise.

"For the business of picking which precincts are important, where you want to walk, and where to target your mailings," he says, "my feeling is that you get someone who knows the district. Someone who knows the city can say this area is renters, this area is this, that area is that, and if we're going to walk precincts here's where we ought to go. Computer analysis on top of that is, in my opinion, blue smoke and mirrors."

Gorfinkel feels that surveys can also be misused or over relied on. Potentially they are useful, but many are too long. For example, if you phone up a respondent with 50 questions, the person often gets tired and gives random answers, or hangs up to go back to dinner. After they've made 10 or so calls pollers also become tired with long surveys, and often they will fake missing data. A survey can also become a worthless ritual when it is used to merely confirm what experienced people who know the area would be able to predict by their own common sense. Nor are they very useful when the methodology is manipulated to obtain a preconceived result.


No substitute for judgment

All of this is not to say that there is no role for computers in decision making. There is—data processing and information formatting. Obviously a campaign that uses typewriters would have a great advantage of speed and legibility over some group

that hand wrote all correspondence. But if those typewriters were used to produce gibberish, the advantage would be worthless. The same can be said of campaign computers. Data processing is no substitute for human judgment. But if it is used intelligently it can prove very valuable in preparing and formatting information for analysis. It is also invaluable in the time consuming but essentially clerical work of organizing the details of a particular plan—such as listing precincts according to specified criteria, or keeping track of canvass results. Thus a campaign that made good use of a computer would have a leg up over an opponent who did not.

A computer for every headquarters

Each year more election reform laws are implemented requiring the preparation and documentation of increasingly complex reports. Small computers can, and do, play the same role here as they do in helping a business prepare yearly taxes. Other staff responsibilities, such as calendaring, tickler files, literature distribution and detail checkoffs, can be aided by an in-house personal computer. Nor should the useful communications potential of in-house systems with modems be overlooked—they have the capability to transmit documents, drafts, reports and memos over the telephone between, for example, an incumbent's office in the capitol and the campaign H.Q., or between a central and branch offices.

Thus, as each succeeding election demonstrates the value of computers in campaign work, and also provides experience in their use, more and more organizations will turn to either a computer service, their own personal-computer system, or some combination of both. With computer capabilities soaring upward, and relative costs dropping fast, there is no doubt that in the near future data-processing equipment will be as common in campaign offices as typewriters and duplicators are now. 

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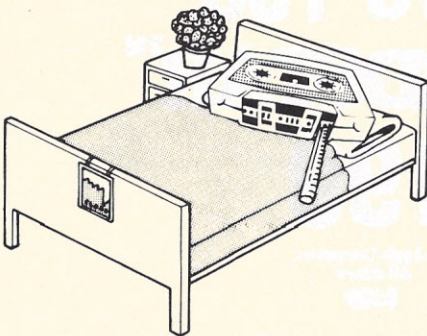
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CIRCLE 80

SPECIAL REPORT

WORTH ITS WEIGHT?

(continued from page 76)

The second type of letter-quality machine is the thimble printer, such as the well known Spinwriter from NEC Information Systems (Lexington, Mass.). Thimble printers have a print element similar to the daisywheel, but the wheel has been folded around the center, so that the hub looks like it's at the bottom of a cup. The rim of the original wheel is the rim of the cup, and the embossed characters are around the rim. The thimble mechanism spins as the printhead moves into position, and actuators tilt it into position to strike the ribbon/paper combination. As with daisywheels, thimble printers are relatively slow and noisy, but have very good print quality.

Comparison shopping

Fully-formed character printers vary in speed, which is self-explanatory, paper-feed method and price. Paper-feed mechanisms are either friction, like a typewriter; pin feed, in which continuous forms are pulled by pins through the printer; or tractor feed, which is similar to pin feed, but with the additional capability of changing the lateral position of the pins. The feed mechanism should be easy to load, as with dot-matrix printers, if a lot of single-sheet feeding will be necessary.

Price is another matter. With letter-quality printers there are two prices to consider—the purchase price and the price of ownership. It is very possible that the purchase price of a low-cost printer, whether matrix or fully formed character, can be completely overshadowed by the cost of operation. If the mechanism is a thermal printer, for example, it doesn't use a ribbon, but it does use a specially coated paper. The costs of the two should be compared to determine the relative cost of supplying each.

Ribbon-cartridge costs are also a factor. If one cartridge costs signifi-

cantly more than the cartridge for a different printer, the cost differential should be figured into the overall ownership cost equation.

The buying decision

The subject of price again brings up the subject of buying a printer. To determine what a buyer should consider, *Personal Computing* asked several printer manufacturers just what those important factors are. The responses received from several of those manufacturers indicated, essentially, that the buyer should consider how the printer meets his needs, and determine its reliability and cost.

Epson America, manufacturer of the Epson MX-80 dot-matrix printer, one of the best selling printers for personal computers today, explains the buying factors this way: "There are three factors that a buyer should keep in mind when shopping for a printer. They are how well the printer's performance capabilities meet the buyer's needs, the printer's cost and the printer's reliability." And Okidata, another manufacturer, says: "The most important factors are print quality, speed, durability, reliability, available options, ease of interfacing and cost." Note that the print quality and speed refer to the printer's performance capabilities, the durability and reliability are two sides of the same coin, and the availability of options and ease of interfacing again refer to performance capabilities.

Other responses from printer manufacturers are in the same vein. But if these are the factors that a buyer should consider, how do they really relate to the task that is to be done?

Performance capabilities, the first buying factor, includes the capability of producing fully formed characters. If you're sure that you need this capability, you have no choice but to buy such a printer, unless you happen to have an IBM Selectric typewriter for which you can get an electro-

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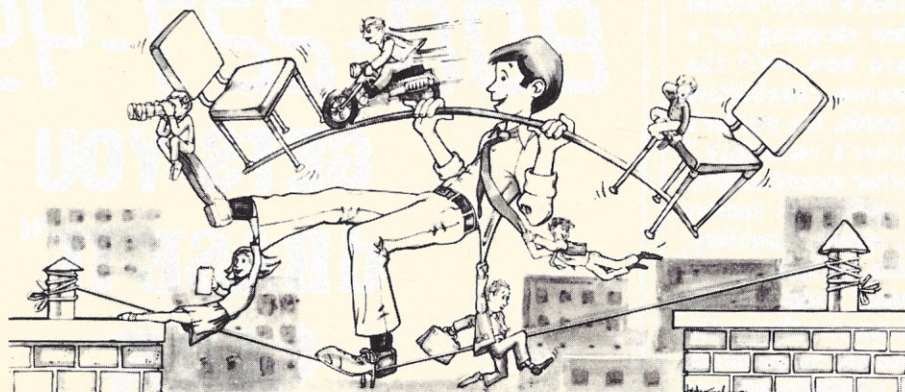
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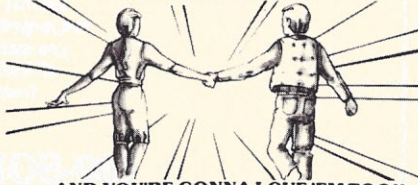
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SPECIAL REPORT

mechanical interface that will push down the typewriter keys in response to signals from the computer. This latter option, though, is fairly slow. And if you don't happen to have a Selectric on hand, you're back to a choice between a daisywheel and a thimble printer.

If your decision about fully formed characters takes you back to the letter quality machines, take a careful look at the available printers of that genre. You'll find that all but one or two (see the printer chart with this article) cost a few thousand dollars. The high price tag is related to the machine's many moving parts, difficult timing and fine tuning to tight tolerances that make the result that the user expects.

Once the "sticker shock" has passed, though, if you're still interested, you'll want to ask a few questions. For example, how many fonts (different type styles) are available, and what do they cost? Similarly, what is the cost of replacement print wheels? They do wear out, and print quality suffers as that happens. Does the printer work with plastic daisywheels, or does it need metal wheels? Some can only use the metal wheels, which are more expensive than the plastic versions, but they last longer.

Another factor inherent in the printer's performance capabilities is the size of its display. You can tell by looking at the printer whether it's limited to about 80 printer columns or if it will print out to 132 columns. If you're going to be doing a lot of spreadsheets and have to print them for transmission to corporate headquarters, a 132-column printer obviates the necessity for explanations about the scotch tape holding together the narrow sheets of paper that are the limit of an 80-column printer. (Not to mention the possibility that someone might wind up typing a spreadsheet that had been done on the computer because "it just wouldn't look right.")

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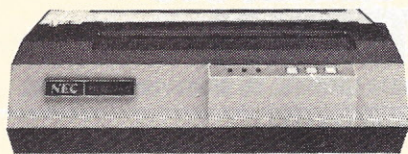
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CIRCLE 65

128 PERSONAL COMPUTING July 1982

SPECIAL REPORT

The need for a certain kind of paper feed should also be factored into any decision about printer performance. Printers have a voracious appetite for paper, especially if they're relatively high-speed models. As noted, fully formed character printers aren't all that fast, but try feeding 100 single-page form letters into a printer that isn't designed for easy single-sheet feeding—the printer's appetite seems absolutely insatiable. If the printer is a higher speed dot-matrix type, its paper appetite is absolutely obscene.

Other remedies

There are other remedies other than easy loading for this condition. Bond paper, or even letterhead paper, is available in continuous-feed configurations. One kind has sheets of paper, and even envelopes, attached to an inexpensive grade of paper that's used only as a carrier for the more expensive bond. Another type has holesto mate with pin-feed mechanisms on detachable side ribbons. This sounds like the old computer printout paper you may be familiar with from earlier times—and it is. The difference is that the perforations that allow for removing the side strips are very fine, so the paper almost looks like normal bond paper, but not quite. But there are printers that are designed for easy paper loading, so be on the lookout for that capability if that's your need.

On the other hand, if you're likely to be producing lots of draft-quality printing, look for a printer that has two salient characteristics: It should have pin or tractor feed, and it should be fast.

Pin feed, which is found on the Epson MX-80, means the pins are in fixed positions at the extremity of the platen, and only accept one width of paper. Tractor feed has moveable pin assemblies, so varying widths of paper can be accommodated. For long documents, pins are needed just to keep the continuous-feed paper lined

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CIRCLE 67

SPECIAL REPORT

up properly as it feeds through the printer. Friction feed, the method typewriters use, can allow the paper to become misaligned, which means the print lines start to stagger downhill at inappropriate times. Pin or tractor feeds can keep this from happening, provided they've been adjusted properly.

The other requirement for draft-quality printing is speed. Slow printing can be agonizing printing, especially if the printer is working slowly on page three of a 20-page manuscript that has to be delivered to the printer in 30 minutes. In that situation, a printer that zips along at 300 characters per second (cps) is much easier to appreciate than one creeping along at 25 cps. Of course, at that speed the printer won't be producing correspondence-quality printing. But for draft copies, who cares?

Printers can also be speeded up. With bidirectional printing, one method for increasing speed, when the printer gets to the end of a line, it prints the next line in reverse order—from right to left. To do this, the machine needs an on-board print buffer that tells it what the end of the line is, since the characters that make up the line are sent to the printer one at a time. If there is no on-board memory (a buffer) in the printer, there can be no bidirectional printing. And that means the printer will take the time to go back to the left of the paper before it begins printing the next line.

Logic seeking is a similar subterfuge. All this means is that the printer will decide if it should print a line backwards, or if it should return and print the line from left to right. When short lines, like those with one or two words that end paragraphs (they're called widows in the printing business), are followed by long lines, it's faster to print the following line from left to right, rather than having the printer move all the way to the right margin before commencing the print.

Printers that have these two features will have line-printing speeds



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CIRCLE 63

July 1982 PERSONAL COMPUTING

129

*"It's a very sad fact,
but in all probability,
at some point
a printer will break."*

ESOTERIC PRINTERS

There are some printers that won't be connected to personal computers for a while, if ever. These devices have fast print speeds, for the most part, and their price reflects that speed. They include laser printers, ion-deposition printers, ink-jet printers and impact line printers.

Laser and ion-deposition printers, called page printers, output a full page of text at a time. A laser printer uses a principle similar to Xerography: A laser beam is directed onto the surface of a photosensitive drum in such a way that the drum becomes sensitized in the areas where the beam has written. The drum then passes through a toner bath and picks up black toner in the areas the laser beam has sensitized. Paper is brought into contact with the drum, and the black is printed onto the paper. The image is then fixed through the use of pressure and heat.

An ion-deposition printer uses a similar principle, but a particle beam is directed onto the surface of a steel drum, upon which it deposits charged particles (ions). The ions then attract the toner. Ion-deposition printers, some manufacturers claim, are more reliable than laser printers.

Ink-jet printers direct streams of ink onto paper by deflecting the ink with a magnetic field.

Impact line printers represent a very old technology. An IBM 1403 printer can go as fast as 1000 lines per minute. It prints a 132-character line at almost the same time using a long line of characters arranged in a configuration called a train. The character slugs, arranged in the train, whirl around a track. When the appropriate character is in the right place, one of 132 hammers (one for each print position) slams the paper and ribbon against the character slug, forming the impression of the character.

faster than the character-printing speed would indicate.

If your needs call more for computer graphics than for speed, be advised that computer graphics is an application area that's just coming into its own on the personal computer. Some printers, like the dot-matrix variety, are well suited for this application. These machines have the capability of printing individual dots when instructed to do so by the computer, and can produce pictures that are much more detailed than printers that are able to print only characters. They do so by printing dots in greater or lesser density in certain areas of the paper as called for by the tone of the picture. These images are called grey-scale images, and they are similar to the half-tone images of photographs found in many magazines. The images are made up of small dots, and the more dots per square inch, the darker the printed image.

If black-and-white graphics aren't enough, and you're one of those people who has a need to generate printer pictures—generally charts and graphs—you may have a need for color printing. That's available too, but at, as they say in the ads, additional cost. Color printers work by placing inks of the primary colors (magenta, cyan, yellow) along with black ink, on the paper. From the three primaries, any color in the spectrum can be generated.

Printers with color capabilities are either impact dot-matrix types that use multicolored ribbons, or ink-jet printers that squirt the inks on the page from a nozzle, deflected by a magnetic field. Such printers are expensive (from \$5000 to over \$10,000) so it's unlikely that most personal-computer users will be interested in obtaining them until costs drop from their present levels.

Well, now that you've decided what capabilities you want your printer to have, you should give some thought to its reliability. It's a sad fact, but in all probability, a printer

will break. There are just too many moving parts in the mechanism for the printer to run indefinitely. You can tell how long one should run in comparison to another by considering the mean time between failure (MTBF) for the printers in question.

The MTBF figure is a fairly good indication of a printer's reliability, but it wasn't determined by having several printers run until something malfunctioned. Rather, MTBF is calculated from formulas that take the reliability of the components of an assembly into account. They don't guarantee that a particular printer that has an MTBF of, say, 1500 hours will run for 1500 hours and then break. But it does mean that a printer with rated MTBF of 1500 hours should run longer without repair than one with rated MTBF of 1000 hours. But either printer could fail much earlier, or much later, than the rated MTBF.

The next important figure of merit is the MTTR, or mean time to repair. As the name implies, that's the average time it should take to fix the printer when something goes wrong. That time doesn't include, of course, the time it takes for the serviceman to arrive, or the time that the printer sits in the shop before the serviceman works on it.

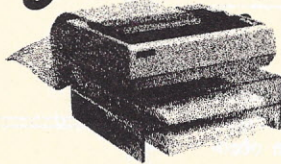
It's because of these unmeasured time periods that many printer manufacturers recommend that you be aware of service capabilities before you buy. Does the dealer provide service, or do you need to send the machine back to the manufacturer? If the latter is the case, does the manufacturer have local service centers, or does the machine have to go all the way back to the factory? And if that's the case, how long will it take? Your employees could get very discouraged if the weekly paychecks aren't printed because the printer is still in the wilds of Wherever, Wisconsin, where it was sent for repair.

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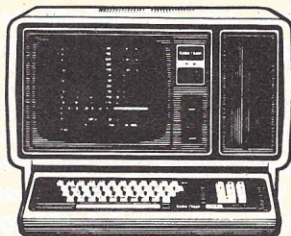
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SPECIAL REPORT

more you will need maintenance. Printers are like automobiles, and not like computers, in this respect. If a personal computer is properly designed and correctly assembled, chances are it will never fail (or the failure won't happen until the machine is obsolete, and that's a very long time). But automobiles, printers and other devices that have mechanical parts just wear out. Light use, though, makes the need for careful service planning less pressing.

Service is a complete subject, and will be addressed in future issues of *Personal Computing*. You should at least be aware, however, that your printer will need it during its lifetime.

Double trouble?

There could also be persuasive arguments for getting two printers. If you have a need for both draft and letter-quality printing, and you need to know that you'll always be able to print, no matter what mechanical disasters occur, then the cost of two printers might be justified. But before making that decision, consider a printer that can print in both data-processing and correspondence-quality modes—their cost is less than the cost of two complete printers.

The only thing you give up with such a printer is a backup in the case of mechanical failure, and two printers can be a problem. Some word-processing programs, for example, want to know at the outset the kind of printer they'll be driving. Switching from one kind of printer to another can confuse these programs. When your program gets confused, so do you, especially if the error messages the program generates aren't very clear.

Keeping all of these buying factors in mind, you should carefully study the available printers before you commit to a purchase. Perusing the printer chart included with this article will show you what you can get for the amount of money you have available.

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LEISURE

BEYOND PRODUCTIVITY

(continued from page 94)

And he could also organize the facts pertaining to a problem into a data structure. The program would, in effect, "weave" the solution out of the threads of data when both were properly organized.

Starr advises starting programming with whatever version of BASIC that runs on your machine, graduating to Pascal within a year, then going on to the C language when you've really gotten the hang of Pascal. He says people should start with BASIC because it's like English. But after a while, he thinks, it's too abstract and symbolic. "Pascal," he says, "teaches you the structure and style you need. It nitpicks you to death, but it teaches. Then you can go on to C, which allows you to go wild. So while it's a good, structured applications programming language, it allows more wildness than you should indulge in until you know the rules from Pascal. Trying to go straight from BASIC to C is like moving from a butter knife to a chain saw."

Programming gives practitioners like Starr a feeling of resourcefulness, a willingness to tackle problems whose solutions appear nebulous or wholly invisible. Even for those who will spend most of their time using applications software, he recommends programming as a powerful mindbuilding exercise. He would also, however, readily agree that one's growth—even with personal computing—shouldn't be limited to this solitary and rigorous pursuit.

Self-improvement software

So far, we've been discussing how people change and improve simply through their use of personal computing. But there are software systems on the market that are aimed specifically at self improvement.

About the time Dot Feldman was getting into computers, she also found out about a software system

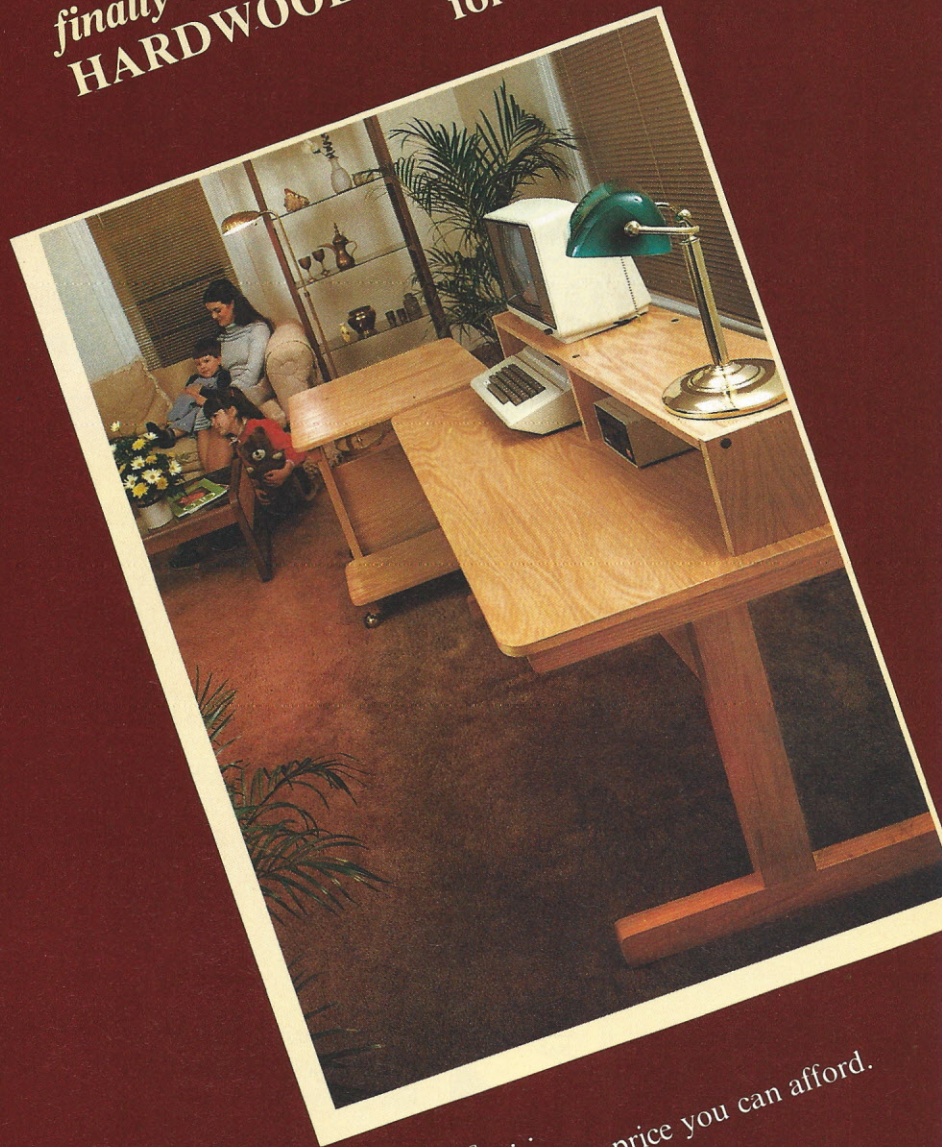
called Neurolinguistic Programming (NLP) from Behavioral Engineering in Santa Cruz, Calif. After she struck an acquaintance with Robert Dilts, the company president, she was asked to test NLP. Feldman says one of the first benefits for her was that helping work out the bugs in the then new software helped her think more logically, because tracking down software bugs requires a lot of logical thinking.

The NLP system comes in two sections of about six programs each. The whole package is called NLP Tools.

The Mindreading program provides a good example of NLP program design. Feldman says "It's really interesting. It asks you to think of a good decision you made. Then you picture yourself making that good decision. As you do so you turn the game paddle all the way forward and back. Then there's a psychological separation period, where the machine makes distracting noises. Then it says 'think of a poor decision you made and turn the game paddle again.' Next it asks you to think of a decision you made—good or bad—and to picture yourself making that decision, whether it was good or bad, and turn the paddle yet again. It thinks for a minute, and then guesses as to whether you were thinking about a good decision or a bad one. After a few repetitions it will approach 100 percent accuracy."

So how does it do that and what good is it? In the first place, it monitors the exact way you turn the game paddle. It creates a file about you based on that monitoring process. The program and that file can then be used for decision support, says Feldman. She stresses that this in no way means a machine made your decisions for you. It just gives you information about your emotional response to a decision you're contemplating. Bringing that response into the mix that creates personal decisions can improve the quality of those decisions, she maintains.

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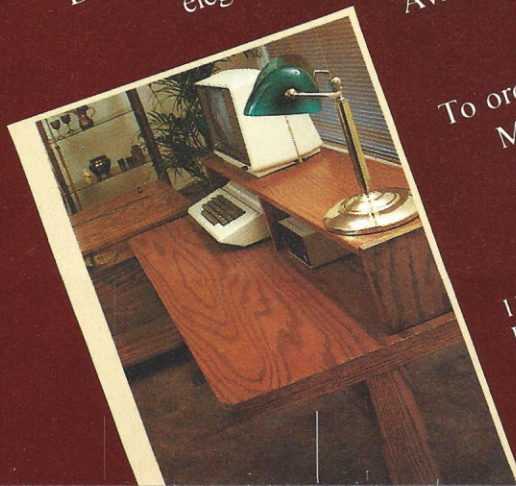
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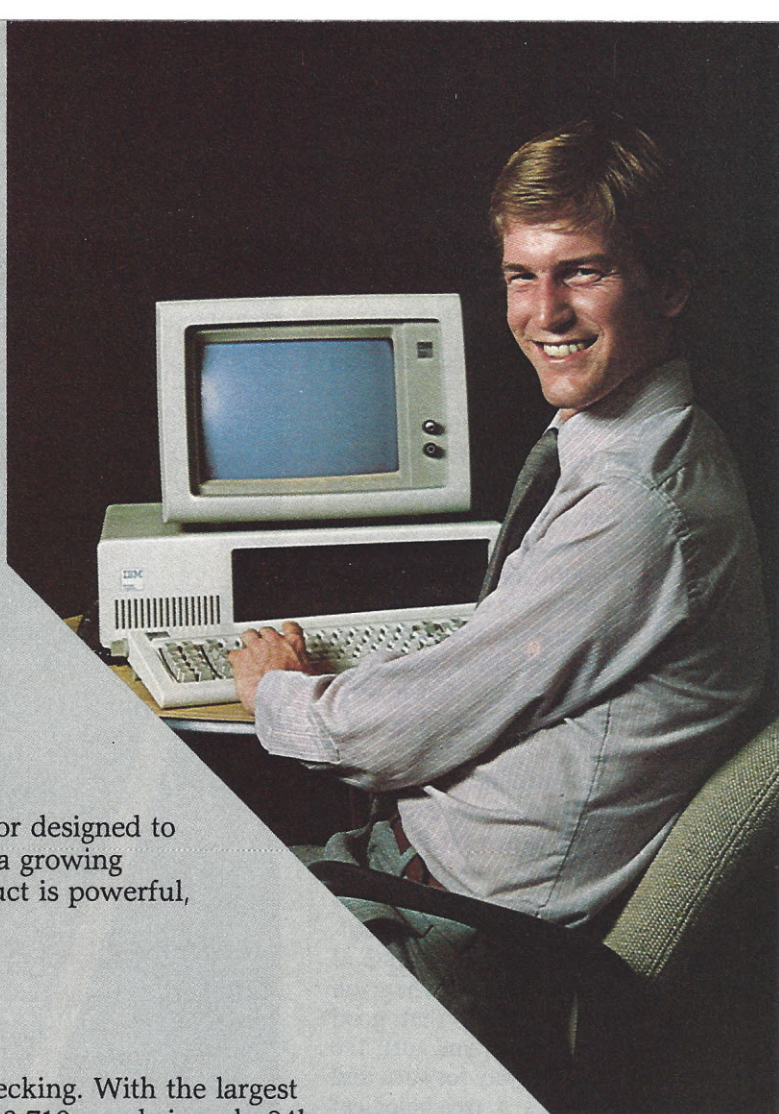


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The next program in the NLP Tools series uses this personal file to help you change your internal state to a more positive one in various specific contexts. Feldman herself has used Mindreader to check out business decisions and also decisions about prioritizing her own time.

Feldman points out that none of this is based on preconceptions of how successful problem solvers work. Rather, Dilts and his associates studied actual human behavior, and they created the NLP programs as models, or simulations of the specific ways people who are good at various tasks perform those tasks.

According to both Feldman and Dilts, NLP software is basically an empirical system. On the other hand, the Life Dynamics Series from Avant-Garde Creations in Eugene, Ore., springs from a theoretical framework, and presents much of the material in the form of games, albeit serious games. Avant-Garde claims the series of 11 programs would be interesting to people involved in the human-potential movement. And like the NLP series, these programs aim at giving one far more than just better skills. They are an effort to give the individual the tools to change the way he deals with himself and others, both at home and at work.

A question of risk

Here as elsewhere there's risk—in this case, the danger of running into oneself (as opposed to one's self-image), and not liking the encounter. For people like Feldman, the opportunity far outweighs that risk.

If there's a specific skill you want to acquire, you can master it via tutorials and simulations of many sorts and quality levels. Astronomy programs can make you at home with the night sky. Flight simulation can help you wing it. Typing tutorials and typing games improve your touch-typing skills and your ability to use the computer as a tool. A Bible-study program promotes spiritual devel-

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opment. Business simulations (like RockRoy's Conglomerates Collide) can hone real-world decision-making skills. Adult-oriented instructional programs cover everything from pharmacology to electronic design.

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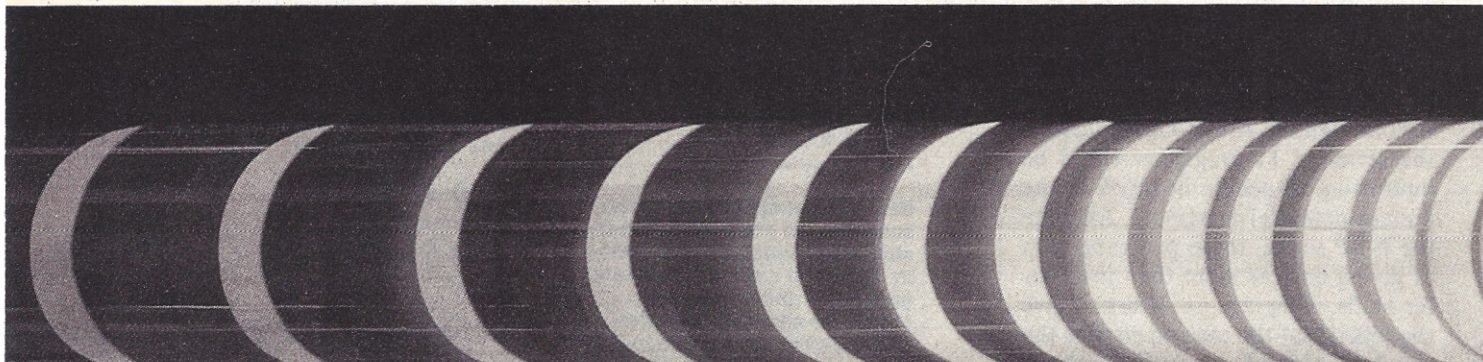
they drag their parents into the computer age. Just at the time when many kids are feeling useless and purposeless, children in these families are experiencing real competence. And they're sharing this.

So for some the benefits come from the skill mastered, and for others from the process itself, especially with one's family. Even when there are real-world benefits, it may be that the most benefit occurs when something is dealt with for its own sake, rather than for the attainment of some external goal. If one is in too much of a hurry to wring profit from an experience, the potential slips through his grasping fingers. And approaching the power latent in a personal computer, we could do well to

emulate Justice Oliver Wendell Holmes' attitude about the power latent in literature. It was reported that Franklin Roosevelt called on him one afternoon shortly after the inauguration in 1933, and found the justice, at age 92, reading Plato. Author Rudolf Flesch reports that Roosevelt asked "Why do you read Plato, Mr. Justice?" Holmes replied, "To improve my mind, Mr. President."

What's the cost?

There's a cost to everything, unfortunately, and personal computing is no exception. Business/professional applications software, programming languages, personal-growth software—all exact a real investment in time and money. And



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"Programming gives people a feeling of resourcefulness, a willingness to tackle problems whose solutions appear nebulous."

the certainty of mistakes, setbacks, and hours of frustration in front a glowing, impersonal CRT. For what? Is increased productivity all there is to it? Moreover, can you use this tool and remain the person you were before, altered in no way but your increased efficiency?

Probably not. Personal computing is a way of doing things in which the tool and the user shape each other. These machines occupy a fundamentally different place in civilization than typewriters, copiers, dictaphones and pbx systems—though each of those does have its own excitement. But computing, and particularly personal computing, is offering something of deep importance to us, on both an individual


and a much larger scale: the ability to actually marshal, control and direct the powerful resources now at our disposal.

On the personal level, computing unleashes our creativity. Now we can model, simulate and revise without having each model, simulation and revision eat up long man-hours. As a consequence, we can be much more eager to go exploring among our options, to try things out even if they seem a bit improbable.

When people don't experiment it's often because they fear the experiment will fail. When failures are confined to a computer's innards, no harm can be done and the search for correct alternatives can be profitable. We all have curiosity, but it gets

dampened by fear of failure, weariness at the prospect of tedious investigations, or the temptation to stick to what already works.

By the same token, we tend to operate off a narrow base of information, because manual cross-indexing is so hard.

Now creativity is enhanced by the ability to access a broad data base. Geniuses can be creative without computers because their unusual minds can handle these two functions. But the rest of us can be creative, too, because personal computing may turn out to greatly increase the amount of functional brilliance available; to us as individuals, to the companies we serve and to our society as a whole. 

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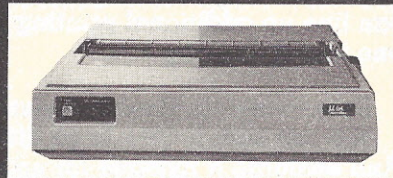
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Is Our Legal System Anachronistic?

On legalities and technicalities

LAW AND THE COMPUTER

MICHAEL C. GEMIGNANI
CBI PUBLISHING COMPANY
BOSTON, MA
244 pp., \$19.95

In *Law and the Computer*, Michael Gemignani argues that America's legal system has not kept pace with computer technology. He writes: "The concepts that served the courts well in the 19th century have been

outstripped by the rapid change in the 20th. Computer law is a very new and rapidly evolving area of law. There is simply no settled body of computer law anywhere."

Gemignani, a noted lawyer and professor of mathematical science at Indiana and Purdue Universities, has written an in-depth, yet easily understandable book that covers all areas of law as it applies to computers and everyday business activities. He notes that a lawyer's highest duty is to keep his clients out of court in the first place by making their position as "genuinely unassailable as possible." However, if that fails, Gemignani

emphasizes that a good lawyer should defend his client with every resource at his command.

Law and the Computer contains an excellent review of the basics of corporate and criminal law, including discussions of contracts, copyrights, patents, slander, libel, trade secrets, warranties and the Uniform Commercial Code (UCC) as it applies to the computer industry. Although parts of the UCC are used in every state except Louisiana as the basis of corporate law, the UCC only applies to goods and merchandise, and not services.

(continued on page 146)

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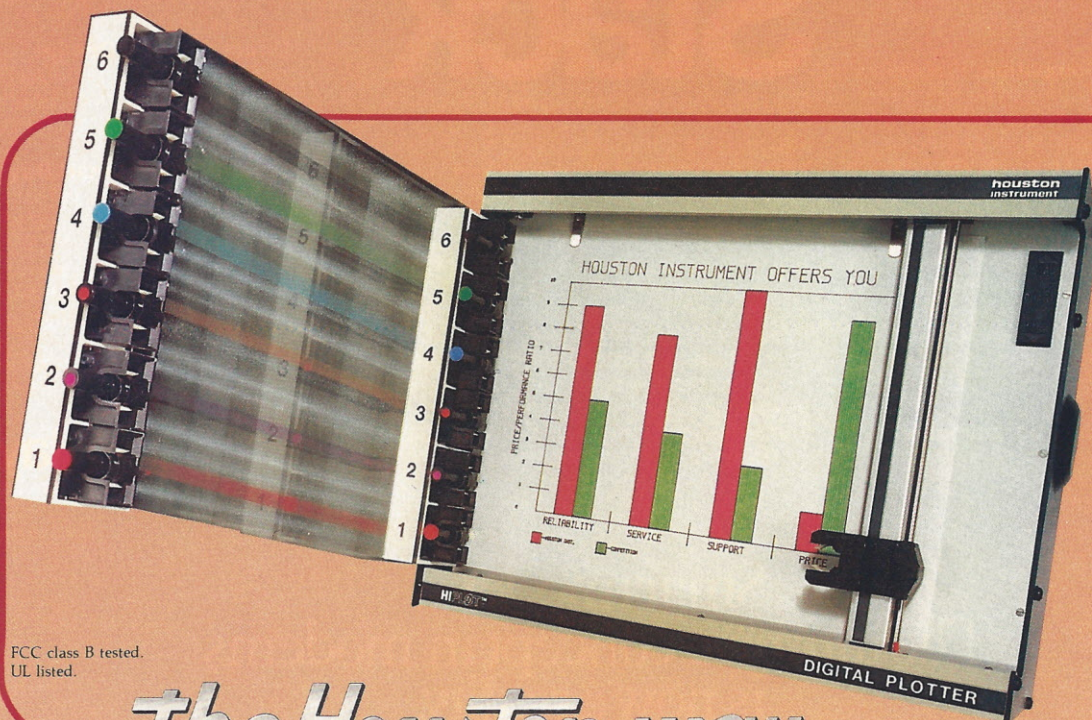
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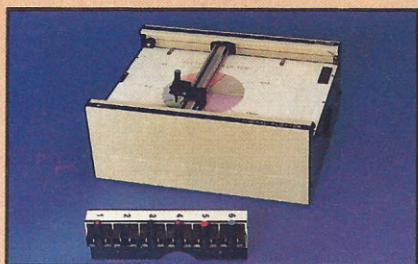
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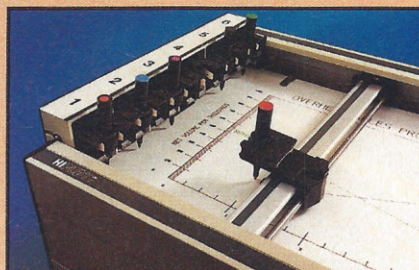
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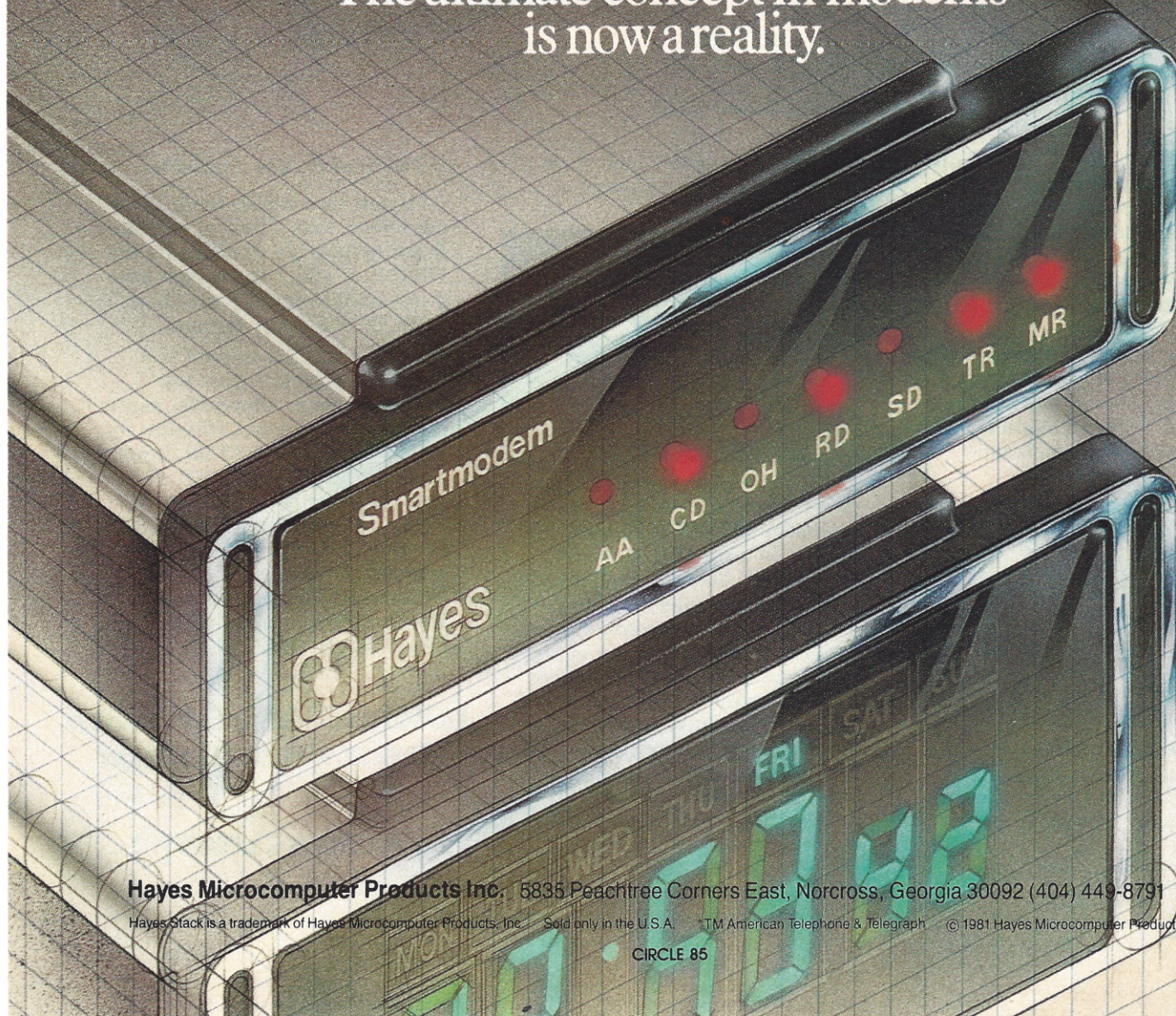
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CIRCLE 85

THE VOICE OF THE FUTURE... HEAR TODAY

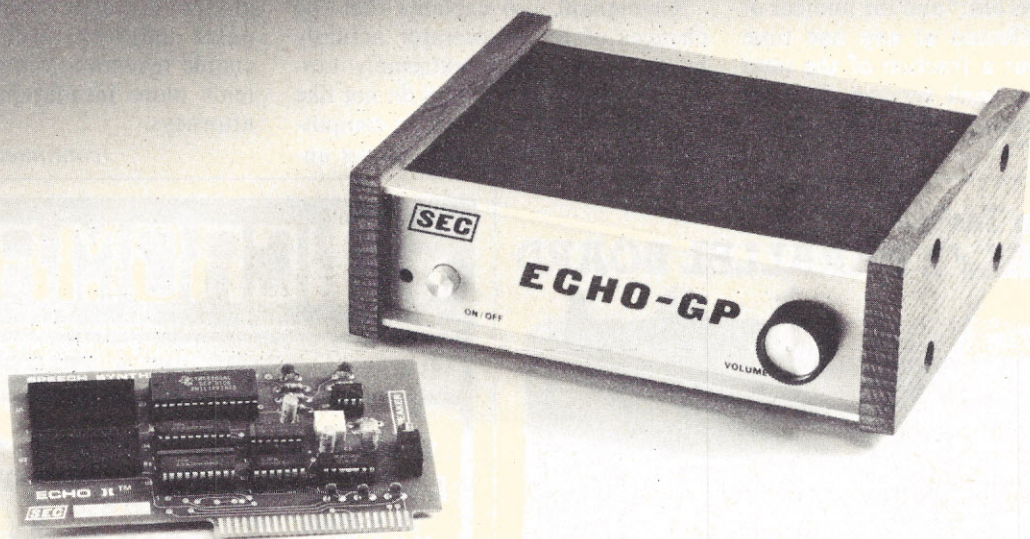
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BOOK REVIEWS

(continued from page 142)

Law and the Computer presents an extensive discussion of computer crime, and focuses on the many problems involved in prosecuting wrongdoers. One common computer-crime method that has been used in many banks is called "the salami technique," because it involves using the bank's computer to transfer very small sums of money from thousands of accounts into an account controlled by the perpetrator. "Only 10 cents might be transferred in a given month from any one account," the author points out, "and the number of accounts affected at any one time would be but a fraction of the total accounts the bank services. But the amount of money siphoned off would be sizeable."

But, as the author says, the real tragedy of this type of crime is two-fold. First, in practice, the bank would almost certainly just pay the small sums and not even conduct an expensive investigation. Second, the book cites a recent study showing that the average take in computer abuse "not counting the massive Equity Funding caper where the take was well above \$1 billion, is \$450,000—more than four times the average loss sustained in 1971 from more traditional embezzlement schemes."

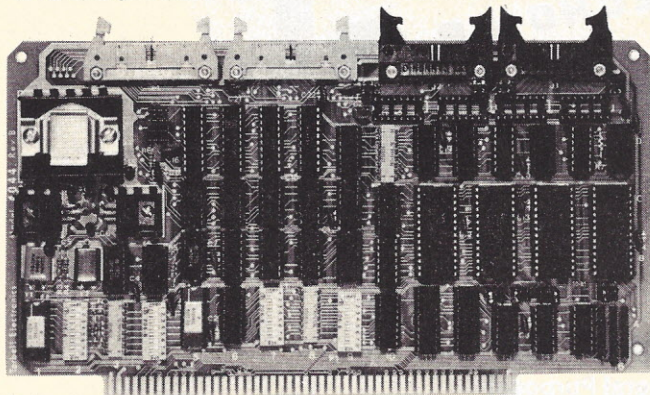
Gemignani also explains that the chances of the perpetrator actually being prosecuted is extremely low. The reason is that judges do not like to handle cases that involve computers because: "They simply do not un-

derstand them. The evidence in computer cases is difficult to gather and harder to understand and explain to a judge and jury in a comprehensible way." And to add insult to injury, Gemignani says that all too often computer criminals "fired for dishonesty from one job go right into another position of even greater trust and responsibility."

Although *Law and the Computer* is no substitute for expert legal advice, a few evenings with the book will enable readers to gain a better perspective of the complexities of modern law as it applies to the computer industry. Moreover, it will enable readers to discuss legal problems more intelligently with their attorneys.

(continued on page 150)

New from Tarbell... 4 SERIAL/2 PARALLEL BOARD



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lines, outputs that will drive up to 30 ma and inputs with less than .4 ma load.

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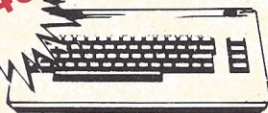
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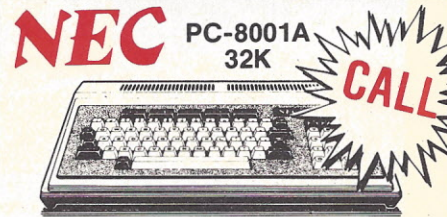
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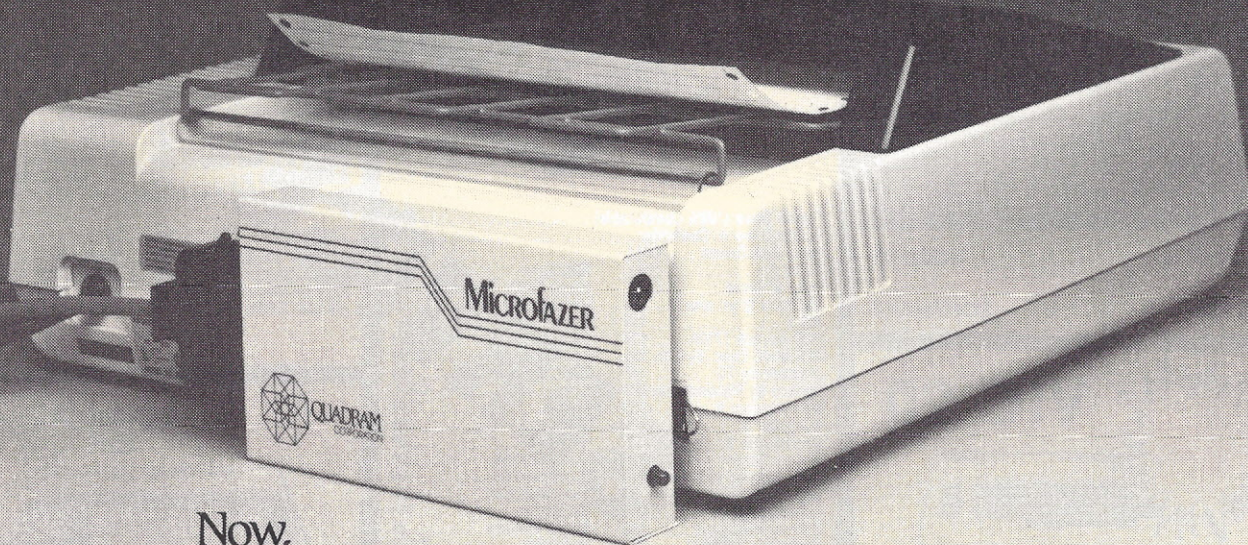
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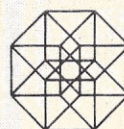
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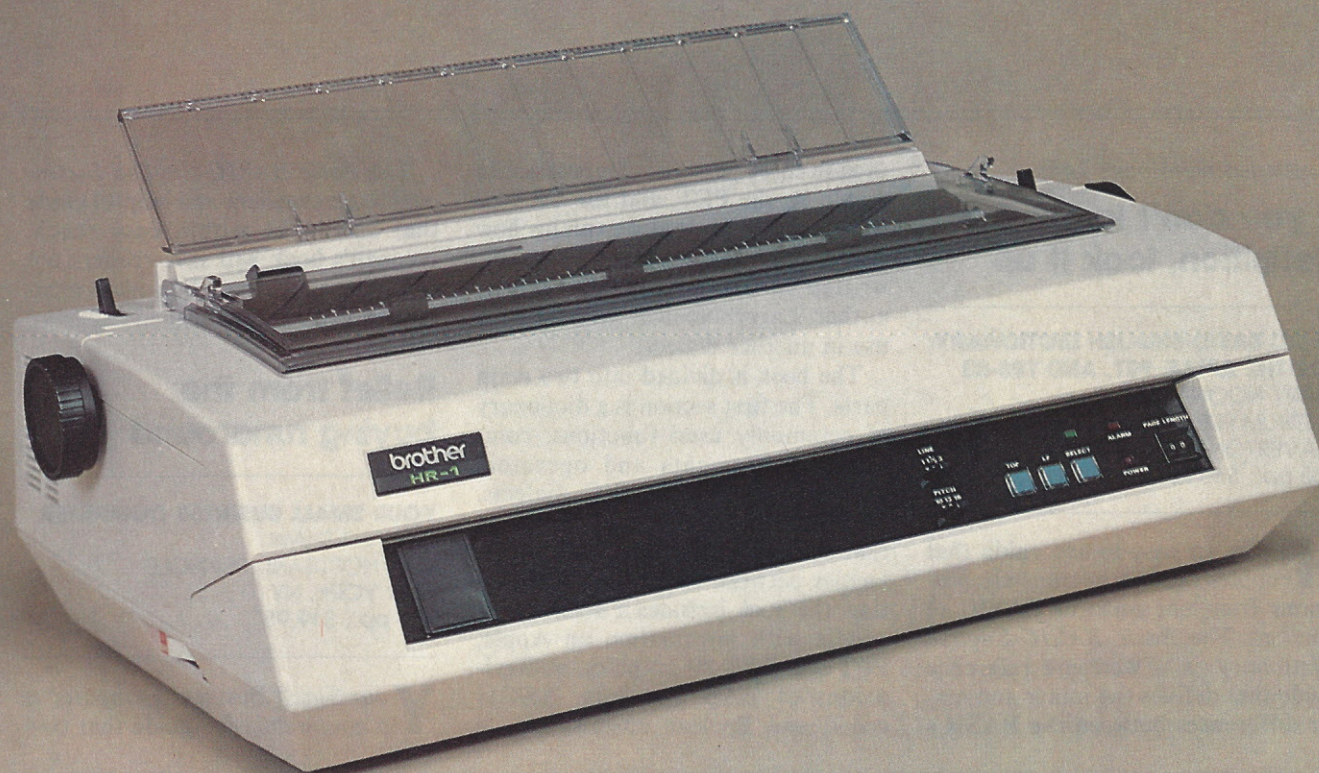
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CIRCLE 69

BOOK REVIEWS

(continued from page 146)

If you don't know the definition, look it up

BASIC BASIC-ENGLISH DICTIONARY: FOR THE APPLE, PET, AND TRS-80

LARRY NOONAN
DILITHIUM PRESS
BEAVERTON, OR
150 pp., \$10.95

Here is an easy-to-use guide that enables readers to translate programs from one form of BASIC to another. The *Basic BASIC-English Dictionary* is a welcome reference guide that defines the minor and major differences between the BASICs

used in three personal computers: the Apple II, the PET, and the TRS-80 Models I and II. It also explains how readers can easily modify programs written in one BASIC dialect—as author Larry Noonan calls it—for use in another dialect.

The book is divided into two main parts. The first section is a dictionary of commonly used functions, commands, statements and operators used in the three BASIC dialects. The second part is a reference chart that shows the differences and similarities between each entry. In addition, the book includes a detailed appendix with information on Apple, PET and TRS-80 graphics, abbreviations of BASIC words, ASCII codes, and Boolean operators.

The *Basic BASIC-English Dictionary* is an excellent and helpful guide that should be within easy reach. Noonan's book will save readers not only time and effort, but much mental anguish and confusion.

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YOUR SMALL BUSINESS COMPUTER

DONALD SHAW
VAN NOSTRAND REINHOLD
NEW YORK, NY
256 pp., \$19.95

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ISBN 0-88056-090-8 \$9.95

★ BASIC BASIC-ENGLISH DICTIONARY For the Apple, PET, and TRS-80 Larry Noonan

This unique dictionary gives you an alphabetical listing of all commonly used BASIC commands, statements, operators, and special keys, then translates them for use on the Apple, PET, and TRS-80 computers. Translating from one BASIC to another is a breeze, as explanations and examples abound!

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ers virtually every area of small computers. Topics include basic fundamentals of computer operations, evaluating various systems, negotiating with vendors and purchasing the equipment. While Donald Shaw's book is directed primarily at first-time personal-computer users, many of his recommendations are applicable to seasoned users of larger computers.

Shaw, the president of a New Jersey-based consulting company that specializes in personal and mini-computers, says recent advances in technology have brought the machines within the reach of perhaps 500,000 new customers. Data processing capabilities, he says, have been improving at between 15 and 25

percent a year, communications technology at about 11 percent a year, while "personnel costs have been rising at about six percent per year (much faster recently)." Therefore, Shaw argues, "Whenever and where-ever computers can be employed in place of labor, it is economical to do so."

The book concentrates on the steps that enable managers to choose the best computer system for their specific needs. After all, warns Shaw, most vendor sales representatives go to school and learn how to get orders, not perform objective analysis. "Left to himself," Shaw writes of a sales representative, "he will propose what he thinks has the best chance of getting the order."

Your Small Business Computer also explains several ways that readers can protect themselves against unscrupulous vendors using a detailed Request for a Proposal (RFP). A good RFP, Shaw writes, should tell vendors: "Here is the kind of system I need. Here's what it has to do for me, in what volumes, and over what period of time. Here is a list of questions I want you to answer. Fill in the blanks."

Shaw also says readers should tell the vendor that the complete RFP will be incorporated into the signed contract. As Shaw states: "It's a little like etching glass or metal with an acid bath. Only the pattern that's fully covered survives; the rest washes away quickly." 

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Martha Eischen

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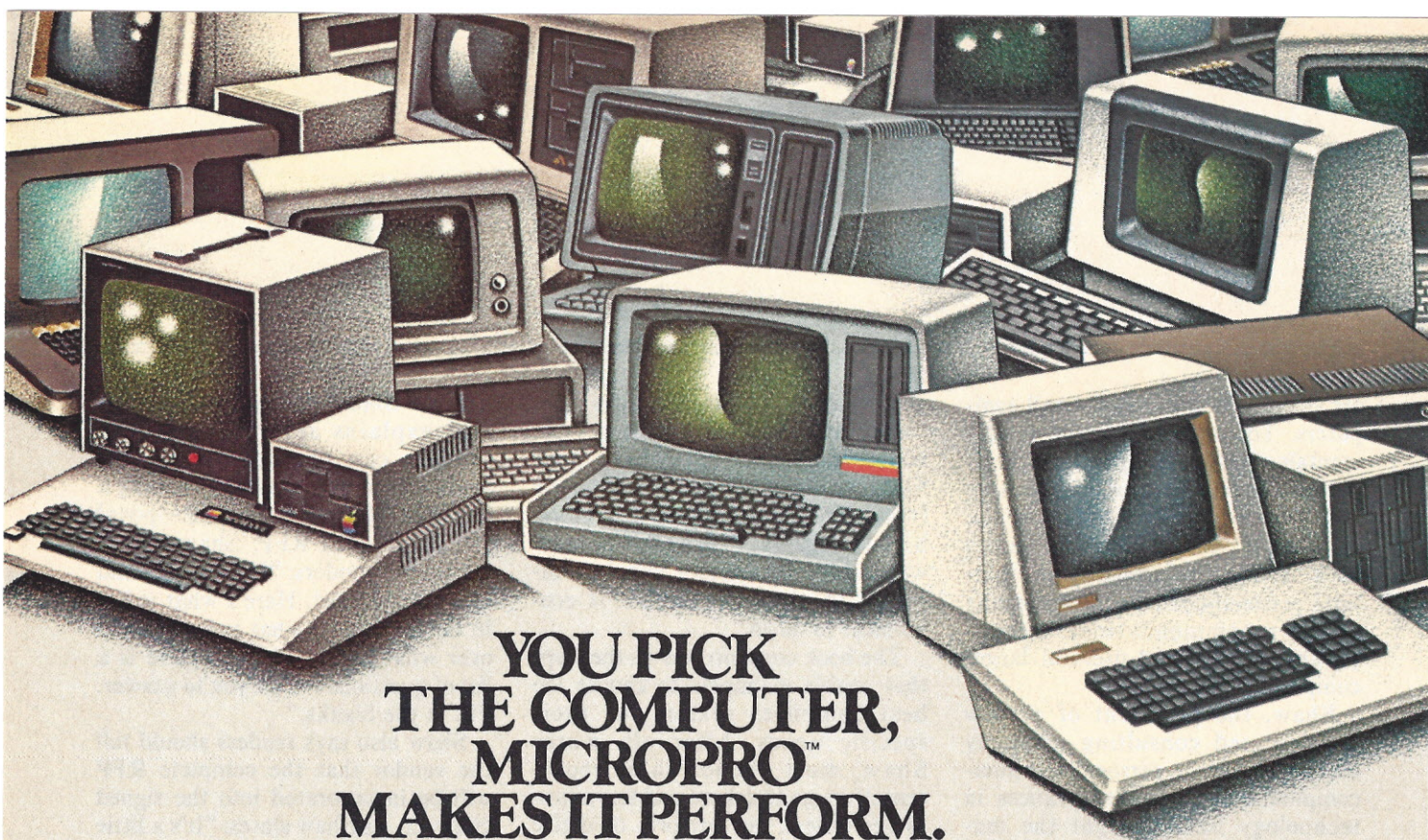
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DEC And Commodore Each Introduce Three New Systems

PERSONAL DEC—THREE SYSTEMS FOR COMPUTING PLEASURE

Digital Equipment Corp., headquartered in Maynard, Mass., and long known as a leader in the computer field, has launched a new series of personal computers that support high-resolution graphics, contain human-engineering features and can be serviced quickly. The new computers include the dual-processor Rainbow 100; the top-of-the-line Professional 325/350 series; and the DECmate II, an updated version of the company's word-processing system.

"This series of products covers a broad range of applications," says DEC president Kenneth Olson, "from the Rainbow, the high-performance, dual-processor unit, to the Professional series, whose key difference is its multitasking ability and bit-mapped graphics. No one else in the industry has it."

The Rainbow 100, the low-end unit, has a dual-processor design, making use of an 8-bit Z80 microprocessor unit and a 16-bit 8088. It is compatible with both CP/M-80 and CP/M-86 through the use of Digital's hybrid operating system, CP/M-86/80. Additionally, this system is compatible with other operating systems including Microsoft's MS-DOS.

The most interesting feature of this unit—aside from Digital's first use of the CP/M operating system—is the system's ability to determine whether an application program is using 16-bit words or 8-bit words. It automatically invokes the correct microprocessor to run the program. The other processor then takes over and acts as the disk controller. This dual capability also allows users access to the most up-to-date CP/M application programs without having to determine whether they are 16-bit or 8-bit.

The basic bundled Rainbow package consists of a stand-alone, slim-profile 103-key keyboard; a 12-inch monochrome CRT; and an 800k, dual 5 $\frac{1}{4}$ -inch disk-drive unit that uses single-sided, dual-density disks. Additionally, the system has 64k of RAM, input/output ports and self-test diagnostics. Optional features include a color CRT, memory expansion to 256k, floppy disk expansion to 1.6 Mbytes, an external 5 Mbyte Winchester hard-disk drive, graphics capabilities and enhanced commu-

nications capabilities. The Rainbow can act as a stand-alone system or can be interfaced with a host system.

The top of the line Professional 325/350 series allows the business or professional user to have not only an intelligent terminal at his desk, but also have this terminal act as part of a distributed data-processing network. With its multitasking ability, a user can perform editing tasks and receive information from a host computer at the same time. The systems can also perform automatic telephone answering and recording by digitizing voice information and storing it on a Winchester hard disk.

Another important feature of this series is its graphics capabilities. The computers can display geometric figures, graphs, plots, curves, and standard alphanumeric characters in normal, bold, underline, reverse, double-width and double-height, and italics. The graphics feature high-resolution bit-mapped images with resolution of 960 by 240 pixels. The user can choose from 256 colors or eight shades of gray on the standard monochrome CRT.

The 325/350's microprocessor is a powerful PDP-11-23 CPU. The unit is capable of 256k of RAM and uses the Digital P operating system. The system consists of a 12-inch monochrome CRT; dual 5 $\frac{1}{4}$ -inch double-density disk drives; a keyboard and optional 5 $\frac{1}{4}$ -inch Winchester hard disk on the 350.

The Professional series also features ergonomic aspects for user convenience. For instance, development of the keyboard and key placement involved nearly 100 technicians who determined the unit's correct height and shape. A user can rest his arms on the desk to use the keyboard, or he can move the keyboard. The typing keys are separate from the function keys, which are located to the side of the typing area. The display terminal can also be set in any configuration for maximum comfort.

Serviceability is enhanced because of the computers' modular design. The only tool required for disassembly is a pen. And the series incorporates common components that are transportable across the entire line. DEC has also planned service hotlines and extensive service support.

The updated DECmate II is a multipurpose, stand-alone unit primarily aimed at business and secretarial applications. However, through the use of a plug-in Z80 card, CP/M is also available.

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CIRCLE 101

HARDWARE OF THE MONTH

The basic DECmate II system consists of a dual 5 1/4-inch floppy-disk drive capable of 800k of storage, 96k of RAM, communications and printer ports, three dedicated slots for CP/M, graphics and mass-storage expansion, and self-test diagnostics. An optional 5 1/4-inch Winchester disk drive is available, as is system expansion for the floppy disks to 1.6 Mbytes.

DEC has entered into agreements with 22 software publishers to develop programs for the new systems. The software includes Microsoft's MBASIC, Mark William's C Compiler, VisiCorp's VisiCalc and VisiCheck, and Select Information Systems' Select word-processing package for the Rainbow 100.

The new systems will be available through Computerland stores and Hamilton-Avnet in the fall. System prices begin at \$3495 for the Rainbow 100, \$3745 for the DECmate II, \$3995 for the Professional 325, and \$4995 for the Professional 350. The optional internal Winchester disk adds \$3900 to the price of the 350. Three optional printers are available, from the \$800, 100 cps LA50 dot-matrix unit to the three-speed LA100 dot-matrix unit at \$3000. A letter-quality daisywheel printer is also available for \$2800.

FOR MORE INFORMATION *Digital Equipment Corp.*,
129 Parker St., Maynard, MA 01754; (617) 897-5111.

MARKET EXPERIENCE BRINGS USER BENEFITS

Making a major push in the U.S. marketplace, Commodore introduced three new personal computers to the public at the National Computer Conference in Houston last month. The new products combine ergonomics and performance with low prices.

"We tried to put our market experience into the design of our new computers both in their technical and human-design aspects," says Kit Spencer, Commodore's vice president of marketing. "And, rest assured, these products will be most competitive in these and other areas."

The three new computers are designated the P-Series, the B-Series and the BX-Series, and all three feature ergonomic factors for user convenience. Among these features are a detachable keyboard with 10 special function keys, a separate numeric keypad and a display screen that tilts and swivels.

The P-Series is a full-color, high-resolution, 40-column computer with 128k of RAM, and uses a television as a monitor. The B-Series is an 80-column computer with an attached video monitor, 128k of RAM, and built-in floppy disk drives with an additional 340k. The BX-Series also features 80-columns and an attached video monitor,

(continued on page 159)



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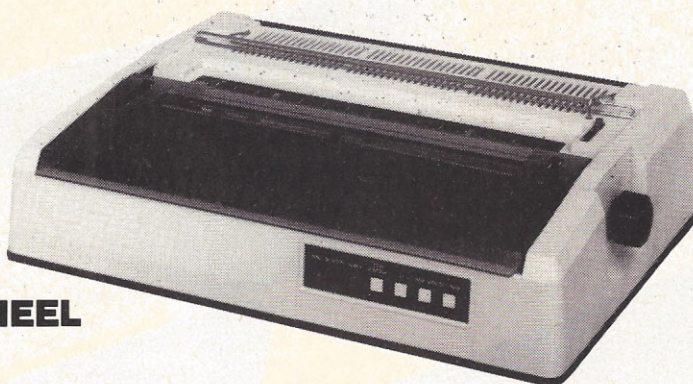
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ONE SOURCE

You have seen several labels on printers looking suspiciously like the F-10. You probably didn't think that a whole bunch of different companies make this printer, and you are right. The F-10 is made by Tokyo Electric Company Ltd., (TEC). They sell printers to a lot of companies. A couple of the better known are C. Itoh Electronics, and Tandy Corporation. C. Itoh Electronics sells TEC printers through their exclusive distributor Leading Edge Products, and Tandy Corporation sell through their own stores.

To compete with these giants we had to buy the printers on a comparable level, and create a whole new group of customers by lowering the price drastically. This would create the best price/performance daisy wheel buy on the market.

We figured that the right combination of an adequate profit margin and a big chunk of the market would produce a real healthy business. Since we have been in the distribution business a few years we had a good idea of the necessary profit margins. We didn't want to be the next Freddie Laker.

We also had learned the lessons of how a real great product can quickly dominate a market (as taught by Epson). So we checked out the high volume buyers prices, plugged all the numbers into good old Visicalc, and Voila, within days of our first ads sales were way above our projections. We had caught the competition napping and were leaving them in

the dust. Keep those cards and letters comin' folks.

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Unfortunately, these printers have lots of limitations. Low speed, low duty cycle, and they require special wheels and ribbons. They aren't capable of running standard software. With the F-10 you don't have to make these compromises to get low cost daisy wheel printing.

THE TECHNICAL STUFF

First, the unit is built on a diecast aluminum chassis. This absorbs noise and vibration making it ideal for office or home use. The power supply is a high reliability switching type for reduced heat during operation. This eliminates the need for a noisy cooling fan. All the sophisticated electronics (including it's own microprocessor) are on just three circuit boards for high reliability. The mean time between failure (MTBF) rating of one year means that the typical failure rate at a 75% duty cycle is one year. In English that means about 2500 hours of trouble free operation. So far our technician is spending a lot of time with the Maytag man.

Warnings for paper out, ribbon out, and cover off, are all standard. The F-10 can use full 16" width paper, with friction or optional tractor feed from the rear or bottom. To top it all off, it has an attractive, low profile case — just 6 inches tall. It's a lightweight at 31 pounds. The printer can be connected to any computer with an industry standard RS232C serial interface. We have interfaced the F-10 with everything from Apples to Zeniths. We will be happy to help you hook it up to your computer. Handshaking by DTR,

XON/XOFF, and ETX/ACK protocols. Baud rates from 300 to 2400.

Superscript, subscript, forward/backward printing, proportional spacing, and 10 or 12 character per inch printing are all standard. Plus all the other good things that standard Diablo software codes do. This makes the F-10 a natural for use with all existing word processing packages that run with printers like the Diablo, NEC, and Qume. The optional buffer chips allow the printer to store and print up to 2000 characters while your computer does other things. The downloading chip provides a clever programmer with additional software commands and the ability to use printwheels whose characters are not in the same positions as standard wheels. Neat stuff.

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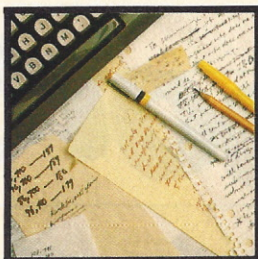
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CIRCLE 106



HARDWARE OF THE MONTH

EXPERIENCE BRINGS BENEFITS

(continued from page 154)

but it also includes a 16-bit multiprocessor, 256k of RAM and built-in dual floppy disk drives with 680k.

The computers are based on a new Commodore microprocessor, the 6509, and can accept a Z80 microprocessor or a 16-bit 8088 microprocessor. Thus, they will be compatible with the many CP/M-based software programs already available. The BX-Series, the multiprocessor model, includes both the Commodore 6509 and an 8088 16-bit microprocessor.

The B-Series and the BX-Series computers are software compatible. Commodore is also in the process of converting software packages such as WordPro and WordCraft to run on the new machines. Plans are also in the works to produce a full line of 6509 software for business, professional and educational applications. In addition, UCSD Pascal will be offered.

The detachable keyboard's 10 special function keys include a double-zero key and four edit keys. Data-entry is accomplished through a typewriter keyboard. The machines, which are designed to use a minimum amount of desk space, are compatible with existing Commodore peripherals including printers and modems.

These new products represent an upward trend for Commodore's user base, says Spencer, who believes that the products will give the company a boost in the U.S. personal-computer market.

At press time, the prices of the new models were not firmly established, but the P-Series will be priced below \$1000, the B-Series below \$2000 and the BX-Series below \$3000.

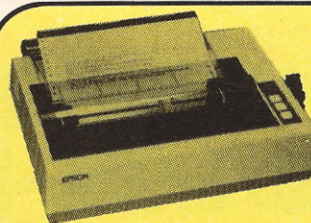
FOR MORE INFORMATION *Commodore Business Machines*, 487 Devon Park Dr., Wayne, PA 19087; (215) 687-9750.

FRIENDLY FRONT END AVAILABLE FOR APPLE

Savvy, the robot programmer from Excalibur Technologies, is available this month for the first time. As previously discussed in *Personal Computing*, (See "A Personal Computing Interview with Jim Dowe," May 1982, Page 30) Savvy is an intelligent front end to computers that allows technically unsophisticated users to enjoy the benefits of computing.

Savvy is, in its most general description, a coprocessor that allows an Apple to operate as if it were a much larger machine. (Savvy will work on other computers, but first production is Apple-compatible.) Since it is a coprocessor, Savvy is like the Z80 cards for the Apple that make the machine act like it's a Z80-based machine rather than a 6502-based computer.

(continued on page 162)



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	LA120 DECwriter III KSR	2,295	220	122	83
	LA120 DECwriter III RO	2,095	200	112	75
	LA12A Portable DECwriter	2,950	280	155	106
	VT100 CRT DECscope	1,695	162	90	61
	VT101 CRT DECscope	1,195	115	67	43
	VT125 CRT Graphics	3,295	315	185	119
	VT131 CRT DECscope	1,745	167	98	63
	VT132 CRT DECscope	1,995	190	106	72
TEXAS INSTRUMENTS	VT18XAC Personal Computer Option	2,395	230	128	86
	TI745 Portable Terminal	1,595	153	85	58
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI Insight 10 Terminal	695	67	37	25
	TI785 Portable KSR, 120 CPS.	2,395	230	128	86
	TI787 Portable KSR, 120 CPS.	2,845	273	152	102
LEAR SIEGLER	TI810 RO Printer	1,695	162	90	61
	TI820 KSR Printer	2,195	211	117	80
	ADM3A CRT Terminal	595	57	34	22
DATAMEDIA	ADM5 CRT Terminal	645	62	36	24
	ADM32 CRT Terminal	1,165	112	65	42
	ADM42 CRT Terminal	1,995	190	106	72
TELEVIDEO	EXCEL 12 CRT Terminal	1,695	162	90	61
	EXCEL 42 Smart Buffered CRT	995	96	54	36
	COLORSCAN 10 Color CRT	3,195	307	171	116
NEC SPINWRITER	925 CRT Terminal	850	82	46	31
	950 CRT Terminal	1,075	103	57	39
GENERAL ELECTRIC	Letter Quality, 7715 RO	2,895	278	154	104
	Letter Quality, 7725 KSR	3,295	316	175	119
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CIRCLE 108

July 1982 PERSONAL COMPUTING

159

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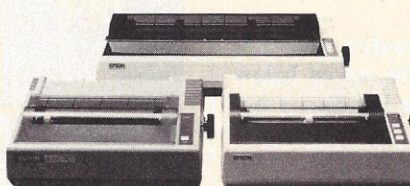
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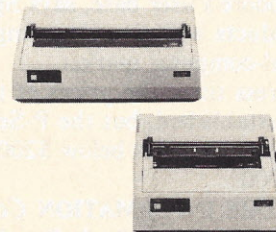
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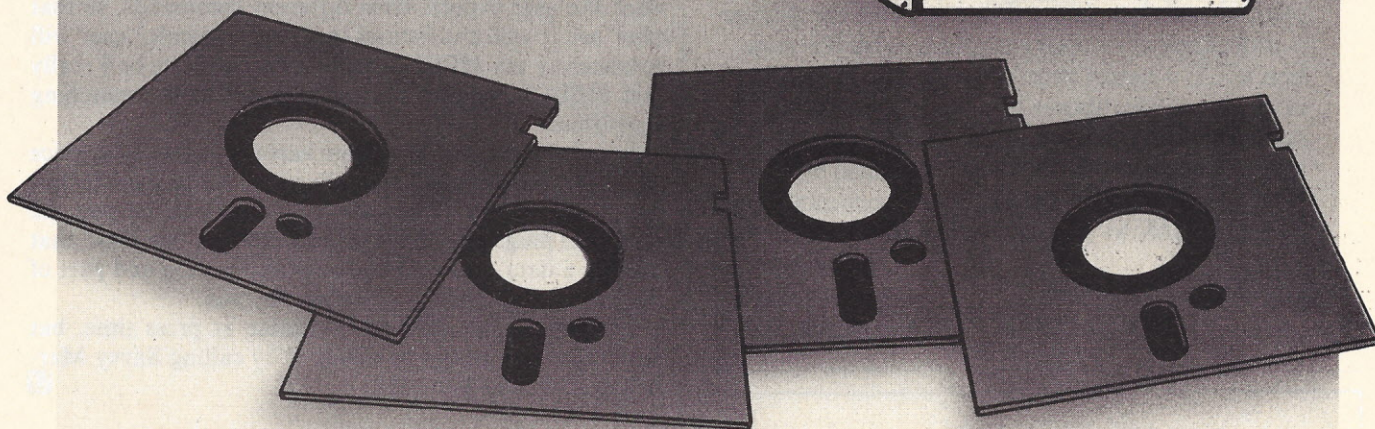
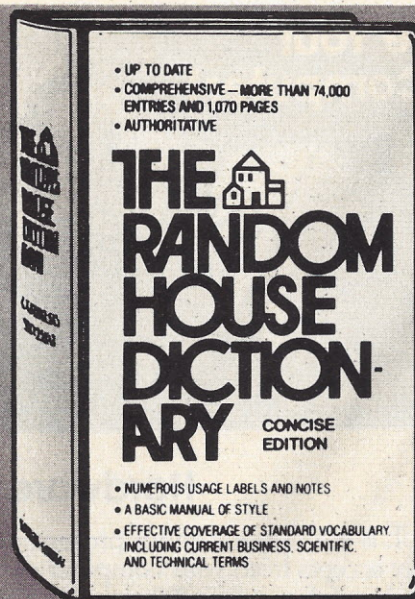
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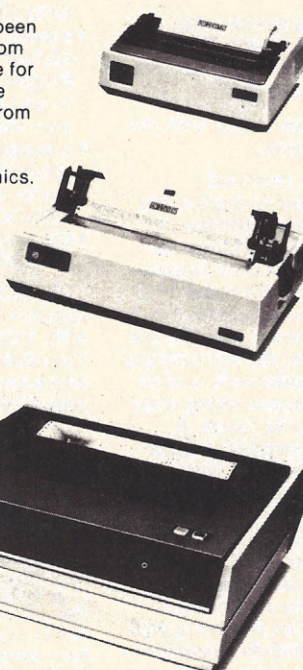
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CIRCLE 111

HARDWARE INDEX

FRONT END AVAILABLE

(continued from page 159)

Along with the processor, Savvy provides an operating system and a language so users can develop programs if they so desire. Also included is the adaptive pattern-recognition system that lets Savvy "guess," for instance, that the user meant to say HELLO when he really said HEELO. This recognition system is also able to "learn" what the user expects from different commands, so that after use it will understand that one particular user will consistently say HEELO, and will act as if he had really said HELLO without having to resort to the matching algorithm.

Savvy will be available from various outlets, at a price of "a cut under \$1000," according to a source from Excalibur Technologies. When the user buys one, he gets the card that plugs into the Apple backplane, two disks that contain a data-base management application and part of the Savvy algorithm, and documentation.

Further details were not available at press time, but more information can be obtained by calling Savvy Marketing at (415) 342-1738



HARDWARE INDEX

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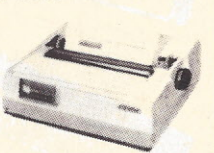
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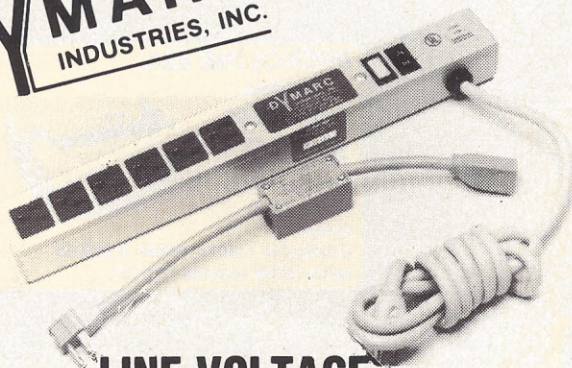
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CIRCLE 113

HARDWARE INDEX

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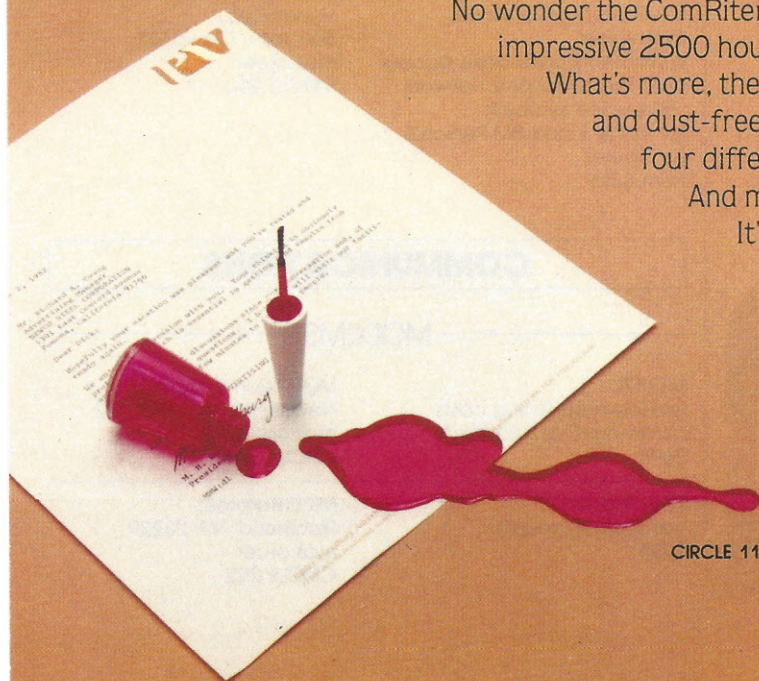
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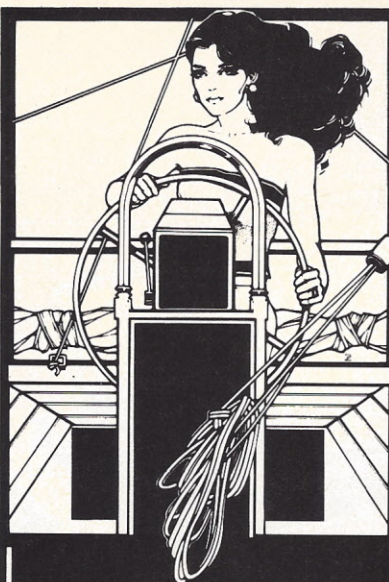


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CIRCLE 140

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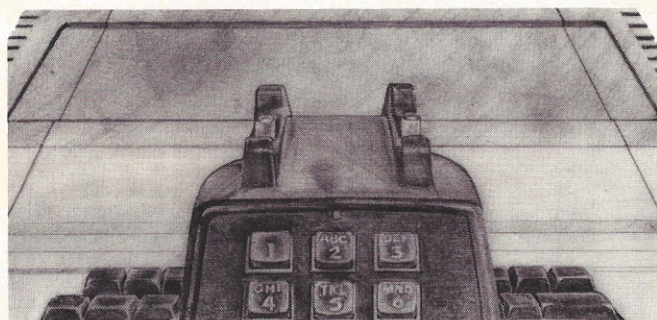
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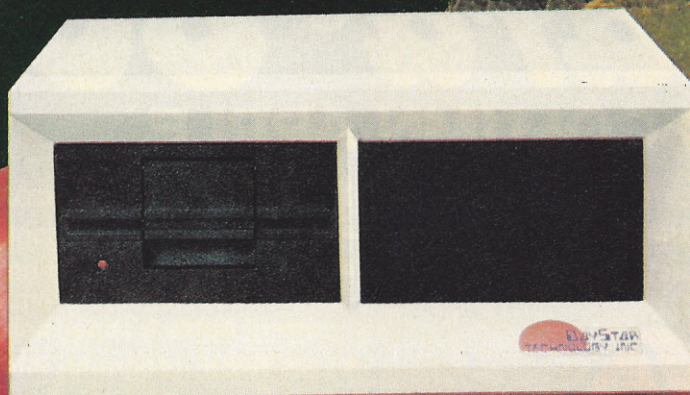
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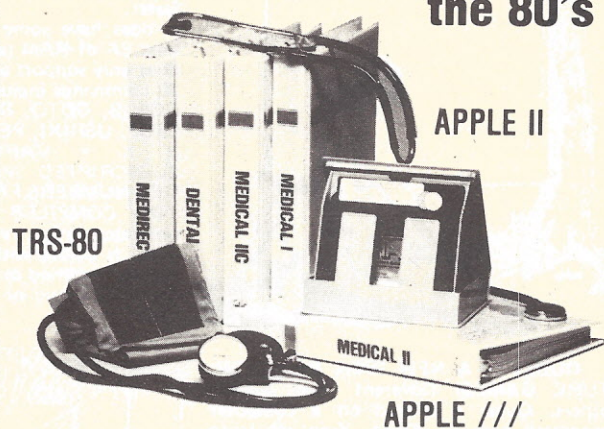


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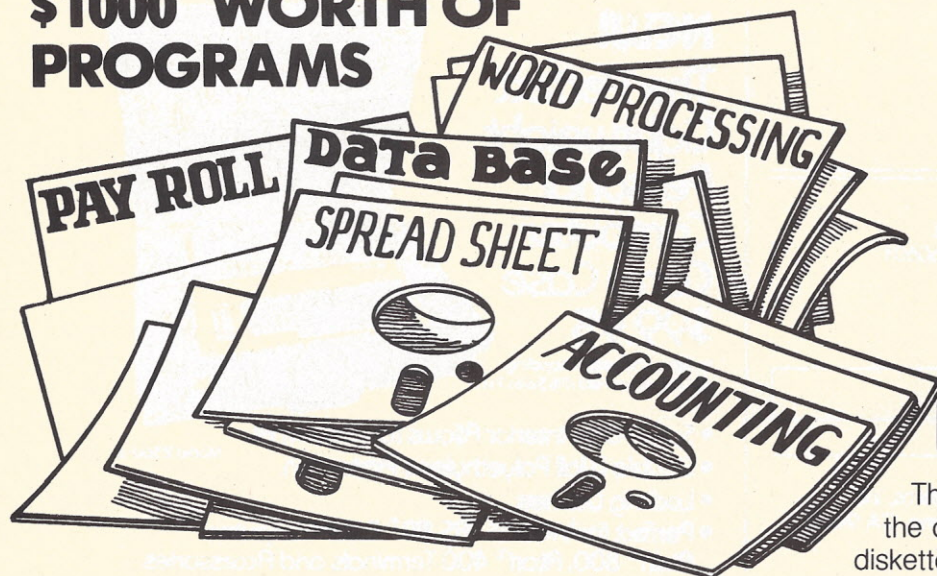
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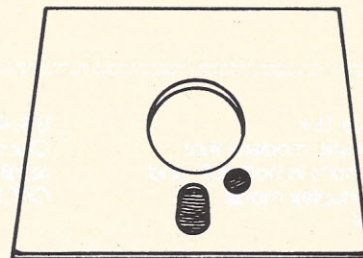
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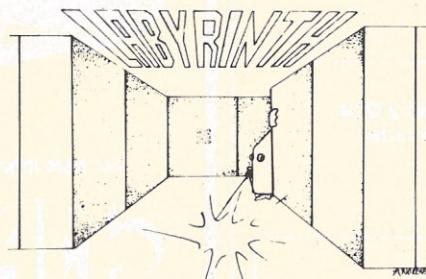
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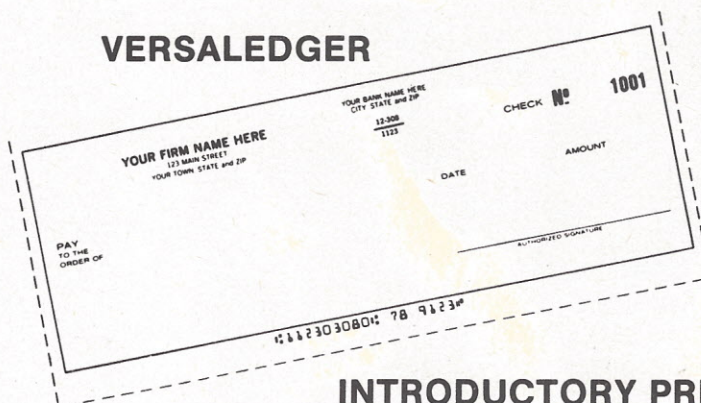
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The package complements BPS' Apple Business Graphics, a color business-graphics system. Screen Director can also be used with almost any other program, such as VisiPlot, that produces graphic images on an Apple computer.

With Apple Business Graphics, the user creates graphic images on the Apple's console and stores them on a data diskette. He can then access that data from the Screen Director program and arrange the images in sequence, typing in a descriptive name for each and telling the computer whether one image, or "slide," should cut or dissolve into the next.

There is a time sequence from one display in the "slide tray" to the next. The user may either use the remote

controller to move forward or backward from one image to another or set up the program to run automatically, with a preselected timing interval. Each diskette holds from 15 to 50 screens, depending upon their complexity.

With the two software packages, the user can also produce word charts in a variety of font sizes and colors, line charts, bar charts or pie charts.

The displays created with Screen Director may be shown on an unlimited number of video monitors simultaneously, and the monitors may be of any size, from an 8-inch Panasonic to an 8-foot Advent or Novabeam. Screen Director also lets the user create hard copy of a whole tray of screen images on a variety of dot-matrix printers, including any in the series of IDS Paper Tigers, Anadex 9000s, the Epson MX line or the Apple Silentyte. The IDS Prism will produce hard copy in color.

Users who want to reproduce graphics on character printers or high-quality vector plotters can do so with Apple Business Graphics, which has a device-independent instruction set that supports the full capability of more than 20 different printer and plotter models. The resolution of the hard copy will be that of the output device, not that of the Apple's graphics memory.

Screen Director consists of a manual binder, a Kodak hand-held remote slide-projector controller with a connector that plugs into the game slot on the Apple, and two diskettes. One diskette holds the program, the other the demonstration data.

The package is priced at \$150 for the Apple II, and \$250 for the Apple III. It is available through authorized Apple dealers.

FOR MORE INFORMATION Business & Professional Software, 143 Binney St., Cambridge, MA 02124; (617) 491-3377.

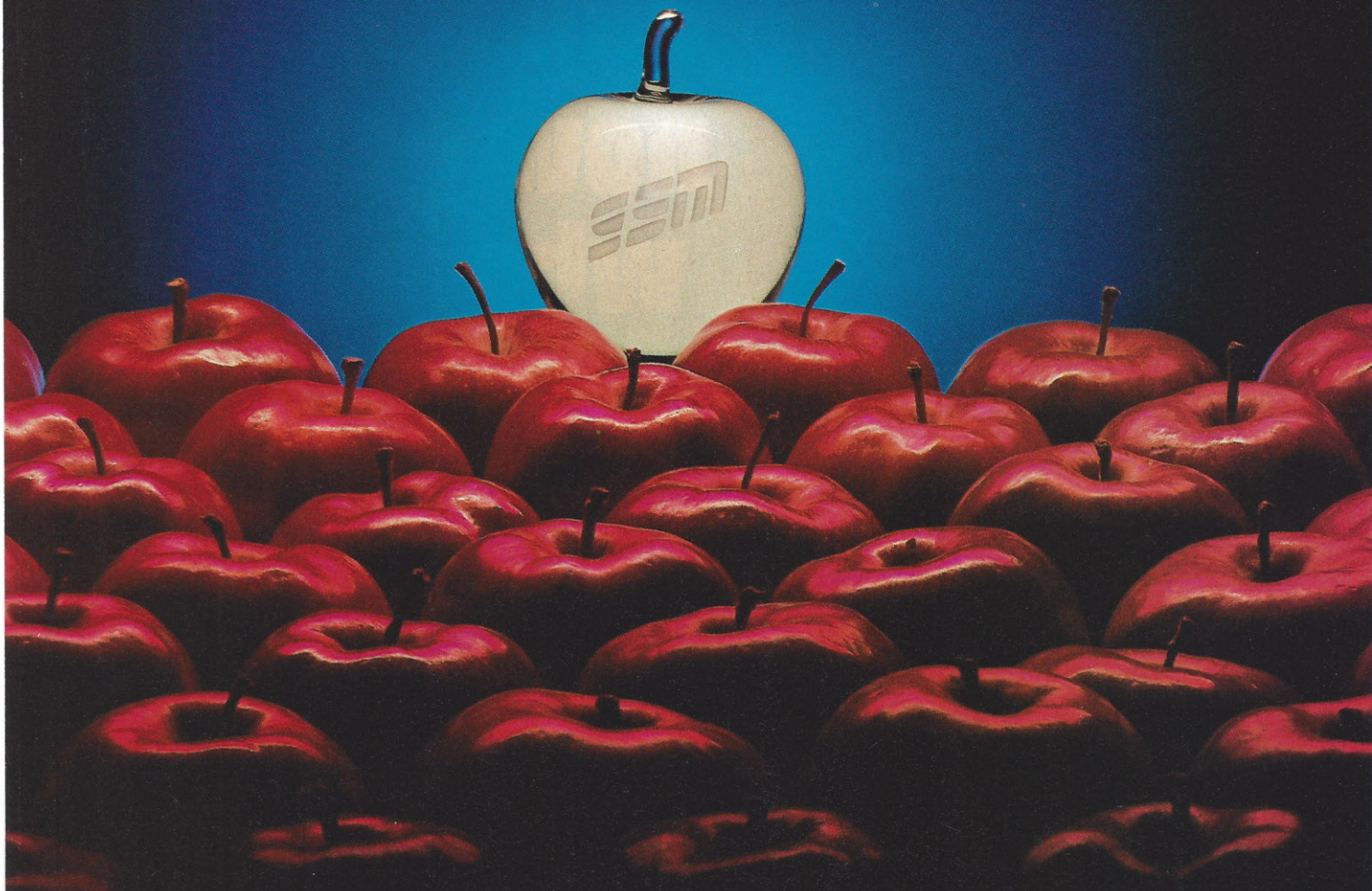
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(continued on page 180)



Screen Director lets a computer function like a slide projector. Here on an Apple III is a "slide" with bars and a trend line.



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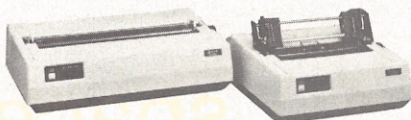
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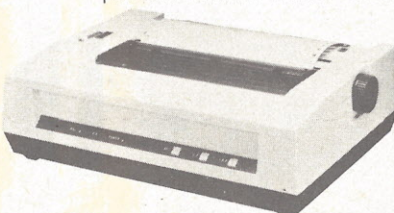
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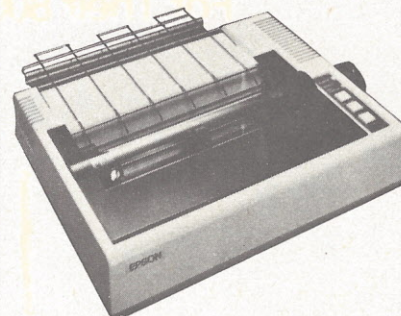
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8510AP	Pro/Writer, parallel	\$ 499.00
1550	Pro/Writer II serial & parallel	Call for price
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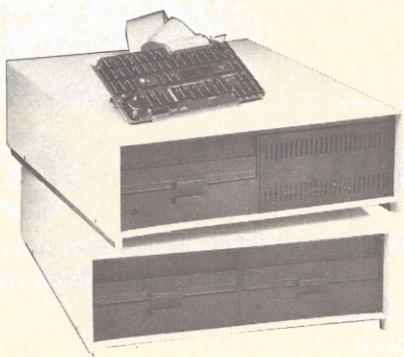
*Graphtrax Plus standard on all models

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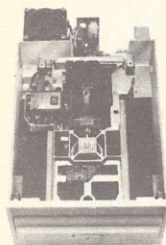


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SOFTWARE OF THE MONTH

(continued from page 174)

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Superscreen was designed to meet the needs of the exploding personal-computer market. Says DeFee, "One objective was to provide a sense of continuity between the various jobs that the professional executes on his personal computer. Using Superscreen, he switches activities naturally without having to worry about programming, about learning new prompting and command conventions, or about manipulating files of data."

The features of Text-Edit are: a full screen editor and print formatter, automatic text justification and pagination, standard printer commands that are easily entered and visible on the screen, multiple file access for greater flexibility in document assembly, and a built-in calculator.

List-Edit, designed as a supplement to Text-Edit, features: "data fields" of variable length and number, an "inverted list" for instant search of the file, and a template feature for creating personalized form letters using a simple fill-in-the-blank command.

The Math-Edit activity features: calculation rules that refer to entire lines or columns for ease of defining models; an expanded set of arithmetic operators, including mean, variance and percent change; built-in plotting; and a "three-dimensional" data layout that accommodates over 6000 data fields. The package requires a Z80 system with 64k and dual floppy disks. The suggested retail price is \$500.

FOR MORE INFORMATION Creative Software Concepts, P.O. Box 349, Binghamton, NY 13902; (607) 729-5558.

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(continued on page 185)

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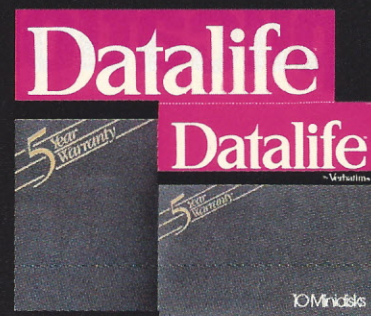
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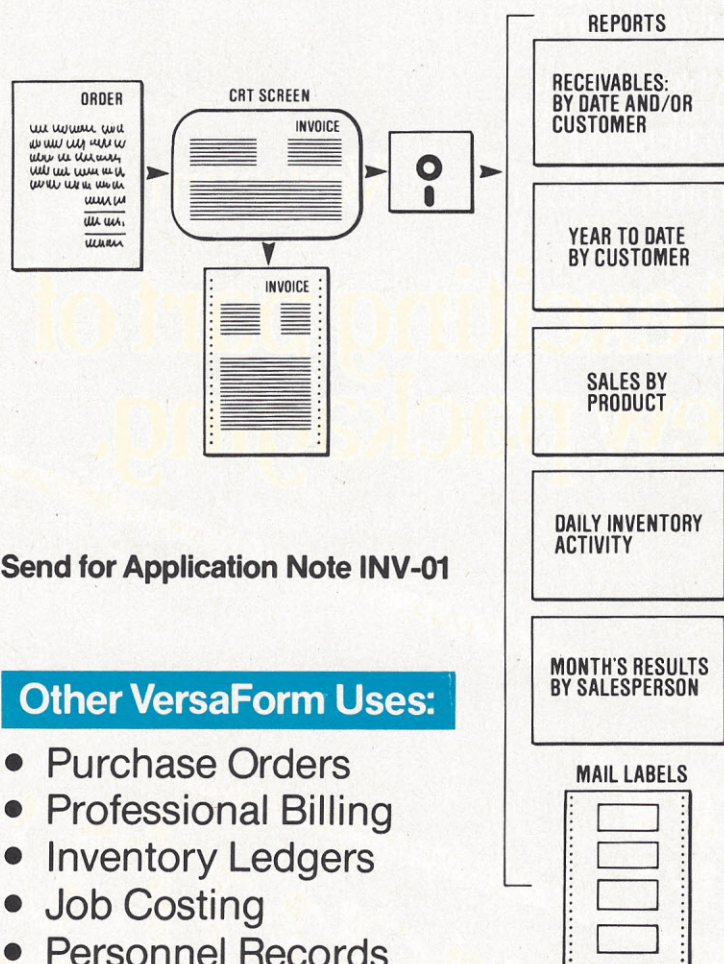
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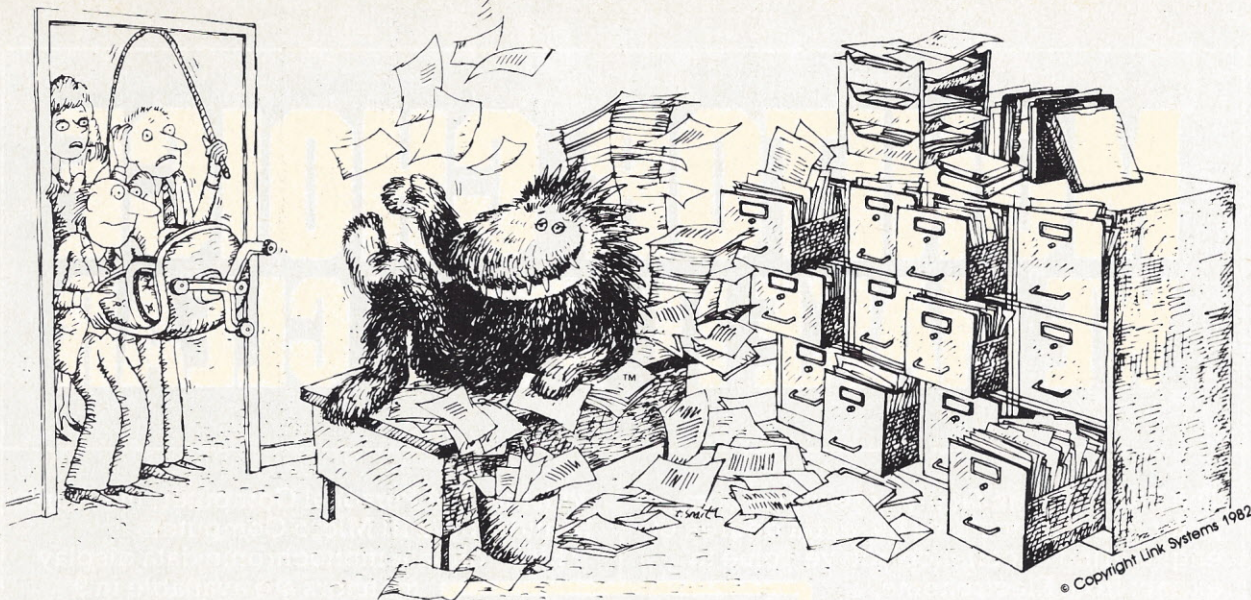
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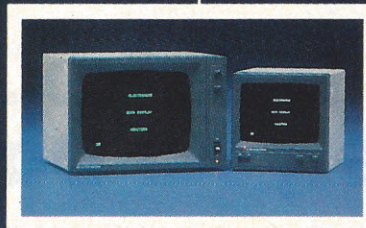
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SOFTWARE OF THE MONTH

(continued from page 180)

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A scan feature searches forward or backward to summarize entries. And entries like birthdays, anniversaries and holidays can be designated to reappear from year to year. Additional features include eight "note-pad" screens, which can be used to quickly reference phone numbers, meeting agendas and price lists.

Time Manager requires a 48k two-disk TRS-80 Model I or III Microcomputer, and is available for \$99.95. **FOR MORE INFORMATION** contact your local Radio Shack store or Computer Center.

PICTURE PERFECT

GraForth, a graphics programming language from Insoft, is used for entertainment, educational, and other graphics software creation. The language is designed for novices and professionals alike, and features three-dimensional color-animation graphics. The package also performs rotation, scale, image transposition and perspective drawing.

Character set graphics are also included with full color, variable character sizes, upper- and lowercase text entry, and a block print command for manipulation of large shapes. Lines are drawn much faster than in BASIC, and colored lines are never broken. Turtlegraphics are included to rapidly draw line shapes at any angle.

In addition, GraForth has a software-based music synthesizer for adding music or sound effects to programs. Music can be played in any one of several possible instrument voices.

GraForth is highly structured, providing easy-to-read code and programs that are fully compiled to machine language. A 220-page tutorial manual provides complete descriptions of the program's operation.

(continued on page 190)

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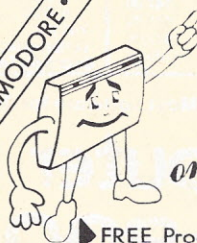
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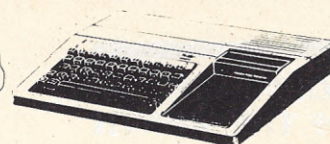
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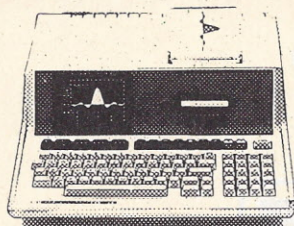
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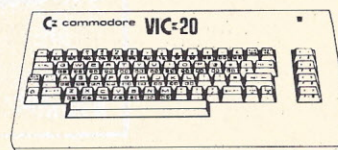
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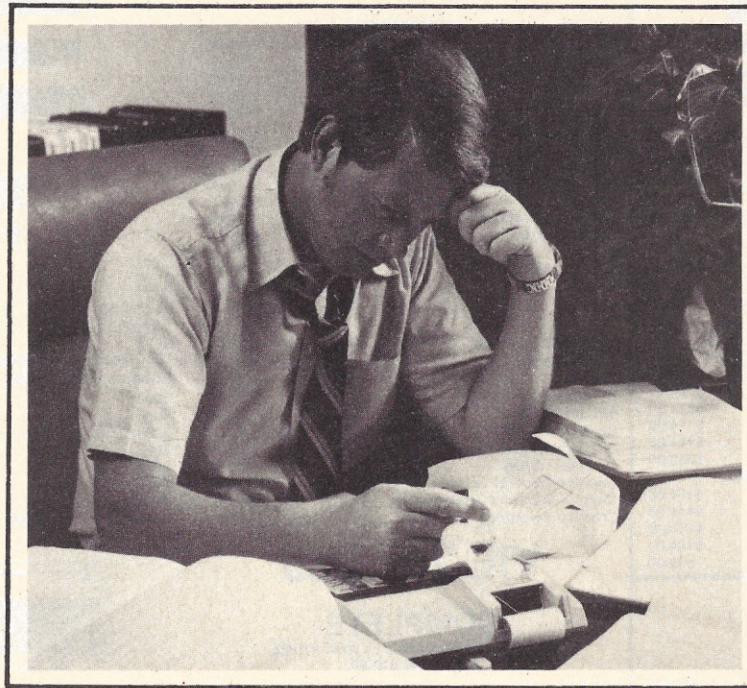
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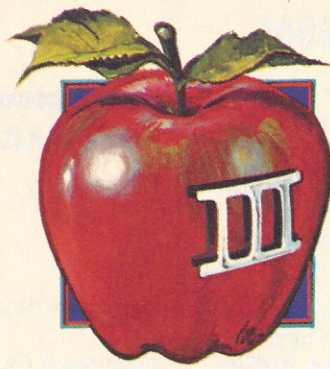
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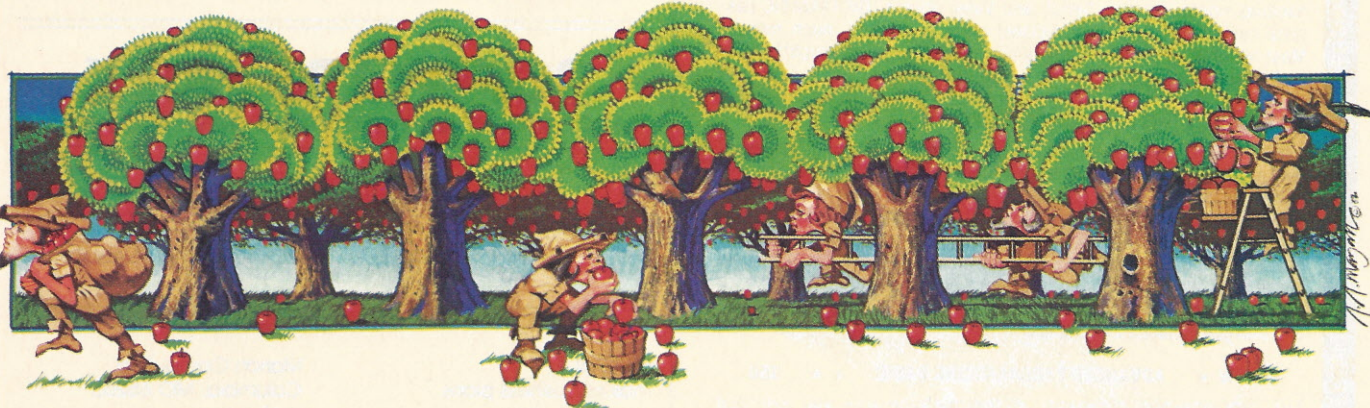
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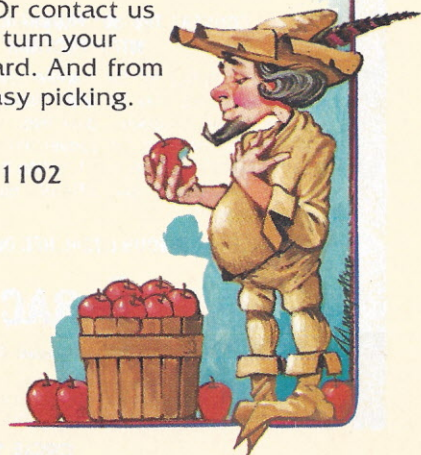
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SOFTWARE INDEX

(continued from page 185)

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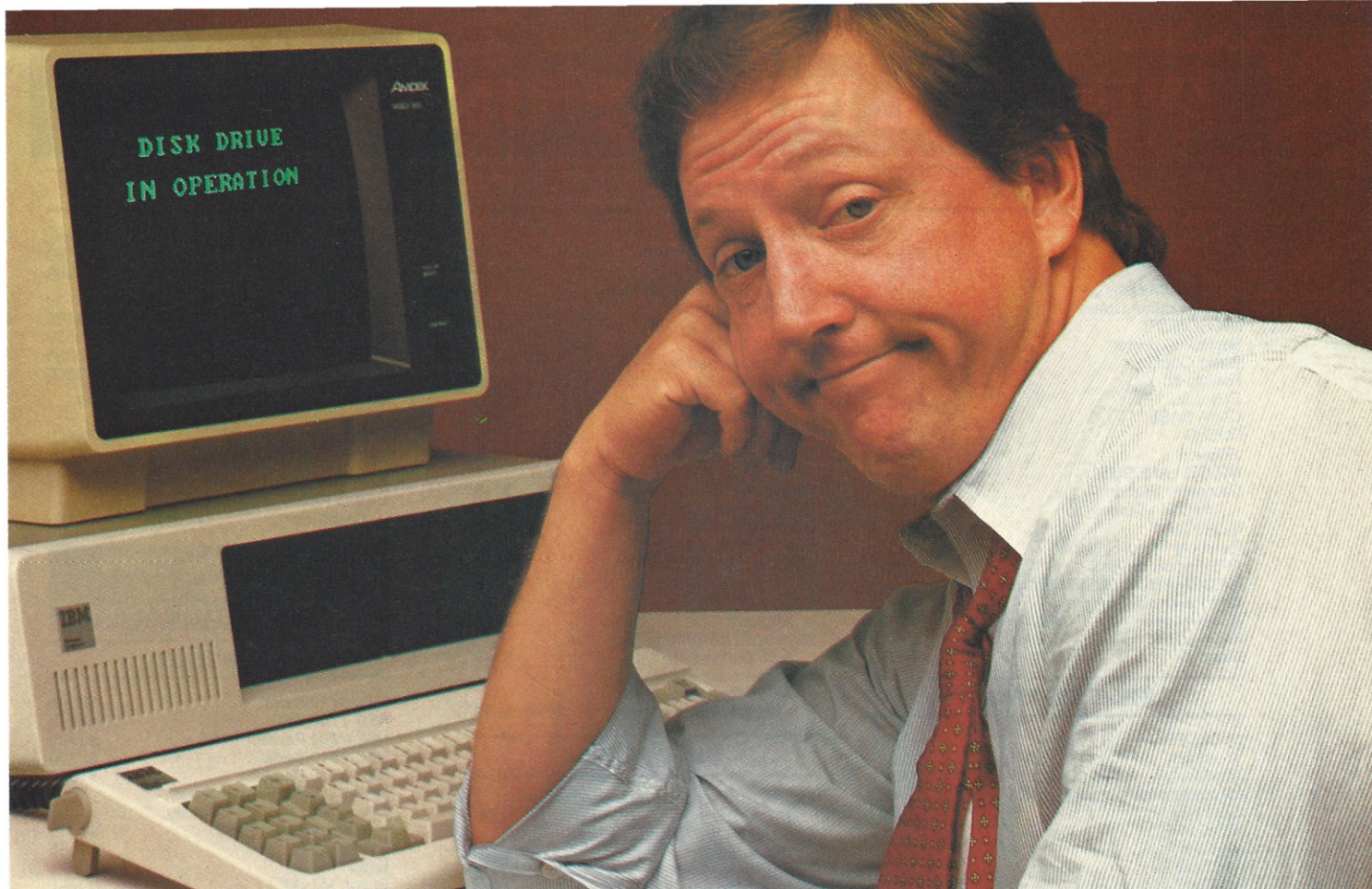
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(continued on page 194)



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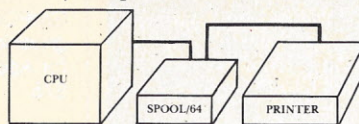


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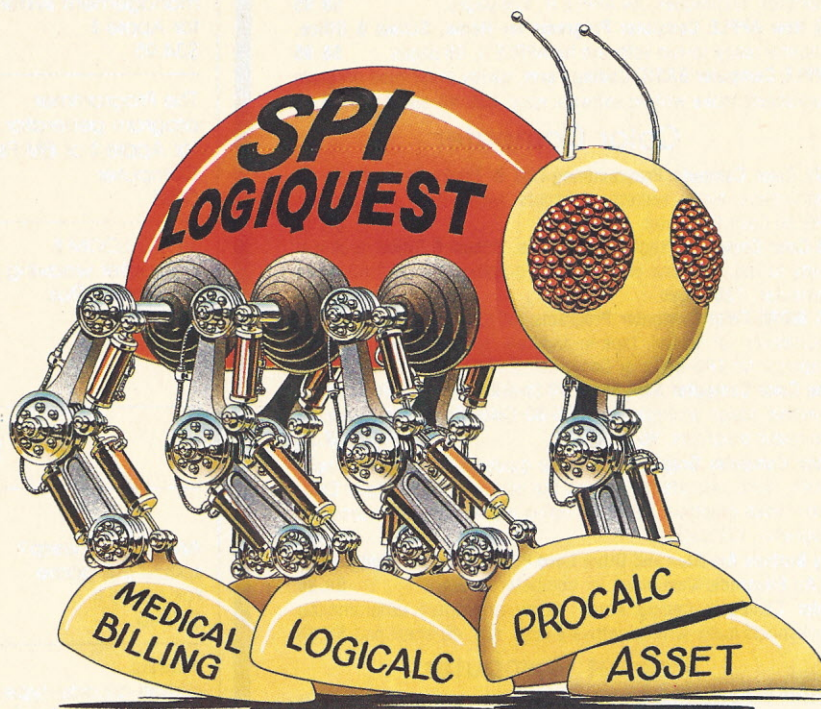
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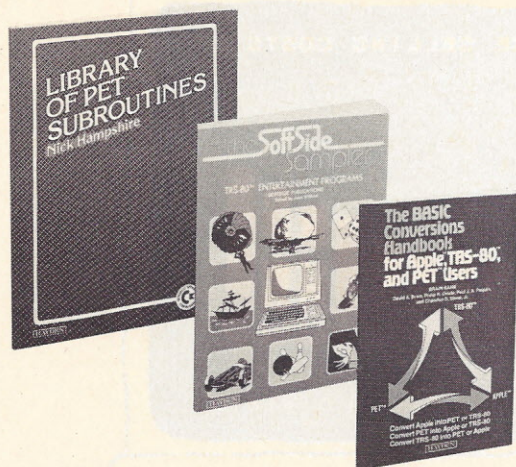
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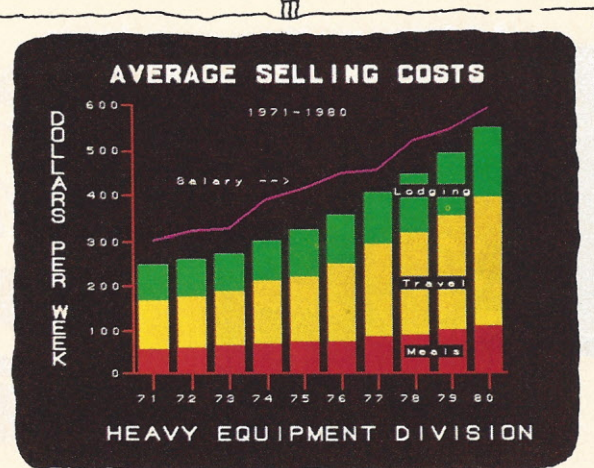
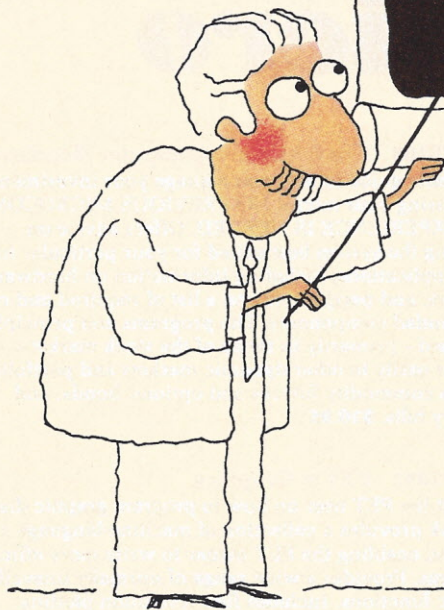
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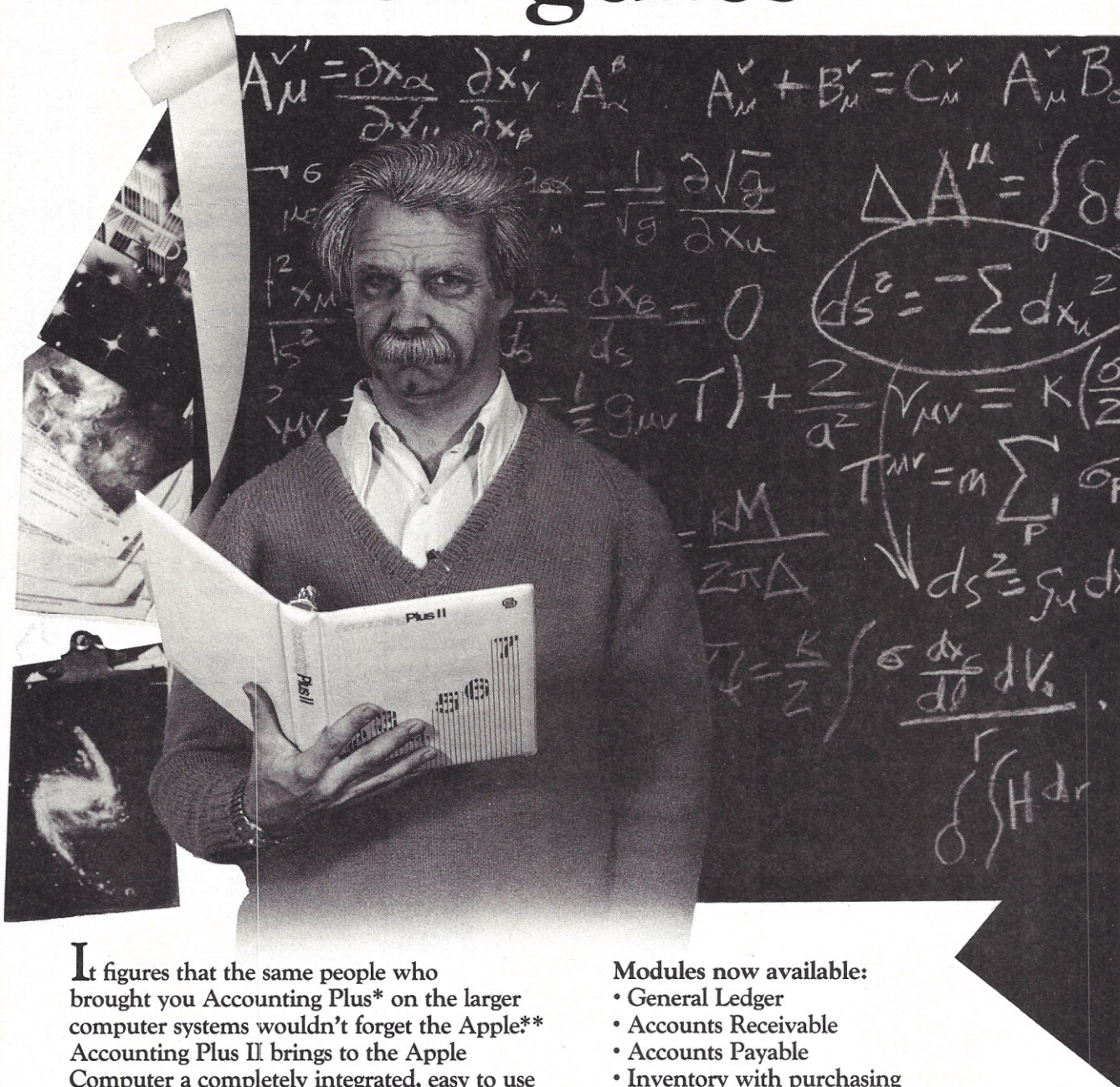
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Poor Richard's Almanac (408) 425-1991
Quement Electrs. (408) 998-5900
Zackit Monterey (408) 375-3144
Berkeley Computer (415) 526-5600
Byte Shop No. 1 (415) 969-5464
Computer Center (415) 845-6366
Computerland (415) 794-9311
Computerland of the Castro (415) 864-8080
Computerland/EI Cerrito (415) 527-8844
Computerland/Los Altos (415) 941-8154
Computerland/San Francisco (415) 546-1592
Computerland/San Francisco/Van Ness (415) 563-4414
Computerland/Walnut Creek (415) 935-6502
Computer Post (415) 790-0410
Computer Store/San Leandro (415) 569-4174
Heathkit Electrs. (415) 236-8870
Keplers' Books (415) 948-5666
Marin Computer Center (415) 472-2650
Micro Age Computer Store (415) 680-1489
Micro Age Computer Store (415) 964-7063
P C Computers (415) 527-6657
Printers (415) 327-6500
Software Emporium (415) 941-8788
Stacey's Bookstore (415) 326-0681
Sunset Computers (415) 665-7378
Systems Formulate (415) 281-2621
Technika Berkeley (415) 524-8934
Computer Scene (707) 462-1578
Santa Rosa Computer Ctr. (707) 528-6480
Zackit Vallejo (707) 644-6676
Advanced Computer Prods. (714) 558-8813
Apple of Orange (714) 974-3082
Byte Shop (714) 565-8008
Capistrano Computers (714) 661-7250
Byte Shop/Placencia (714) 524-5380
Computer Age (714) 565-4042
Computerland (714) 464-5656
Computerland (714) 560-9912
Computerland/North (714) 434-3300
Computerland/San Bernardino (714) 886-6838
Computerland/W. Los Angeles (714) 560-9912
Computerland/CA (714) 598-7505
Computer Merchant (714) 583-3963
Computer Metrics (714) 579-8066
Computer Post (714) 695-2000
Computer Store (714) 661-8062
Computer Store Chula Vista (714) 281-0285
Computer World (714) 691-2584
Consumer Computers (714) 465-8888
CTC-The Computer People (714) 565-0505

Heathkit Electro Center (714) 776-9420
Idea Computers (to come)
Integrated Circuits Unltd (714) 278-4393
James Games Computer Center (714) 985-3278
Marvac Electrs. (714) 540-3280
Net Profit Computers (714) 750-7318
The Computer & I (714) 552-0503
The Washab Apple (714) 768-3236
Byte Shop (805) 647-8945
Compusup (805) 942-5747
Computer Plaza (805) 687-9391
Computer Plus (805) 963-4542
Computer Shop (805) 963-1325
Computer Solutions (805) 922-6639
Computer Sound (805) 945-5921
Computers To-Go (805) 496-2868
Dow Radio (805) 486-6353
QPSB Personal Electr. (805) 967-7100
Ventura County Computer Center (805) 648-5059
Byte Shop/Sacramento (916) 961-2983
Capitol Computer (916) 483-4729
Computer Place (916) 221-1312
Computerland/Redding (916) 241-7922
Computerland/Sacramento (916) 920-8981
On Line Computer Center (916) 338-5447
Student Bookstore (916) 895-6044
Zackit Electrs. (916) 446-3131

COLORADO
Aparat (303) 741-1778
Colorado Computer Sys. (303) 426-5880
Computer Connection (303) 449-8282
Computer Connection (303) 449-8282
Alpine Computer Ctr. (303) 574-4170
Computer Shack (303) 564-3545
Computer Works (303) 449-6233
Micro Computer Mgmt. (303) 493-5700
Whole Life Distributor (303) 861-2825

CONNECTICUT
AM Computer Prods. (203) 621-2331
Aetna Life Club Store (203) 273-3058
Bright Ideas (203) 453-6665
Computer City (203) 521-2245
Computer City (203) 562-7546
Computer Ease (203) 877-7447
Computerland (203) 235-9204
Computerland/New Haven (203) 273-4807
Computer Store (203) 563-9000
Computer Store (203) 356-1920
Computer Store (203) 627-0188
Computer Works (203) 255-9096
Excel Sys. (203) 348-5894
Harold's Drugs (203) 583-1854
Logical Systems Inc. (203) 677-4557
Micro Age Computer Ctr. (203) 846-0851
Technology Sys. (203) 748-6856

DELAWARE
Computerland/New Castle (302) 738-9656
Computer Store (302) 478-7772
Micro Products (302) 762-0227
The Smoke Shop (302) 655-2861
Computerland (304) 624-6409

DISTRICT OF COLUMBIA
Computer Store (202) 272-0294
Pentagon Book Stores (202) 695-0870
Program Store (202) 337-4693
Students Book Co. (202) 223-3327

FLORIDA
Evans Business Computer Sys (209) 576-0451
A I Personal Computer (305) 339-8914
Allstate Business Center Ltd. (305) 665-1013
Baron Electronic Sales (305) 556-1300
Byte Shop of Miami (305) 264-2983
Clarks Out of Town News (305) 467-1543
Computer Ctr./Palm Beaches (305) 689-3233
Computer Image (305) 271-1224
Computerland/Boca Raton (305) 862-6202
Computerland/Ft. Lauderdale (305) 368-1122
Computerland/W. Palm Beach (305) 566-0776
Computer Scene (305) 644-3338
Computer Scene (305) 945-1014
Computer Scene (305) 238-7238
Electronic Equipment Co. (305) 871-3500
H.I.S. Computerization (305) 254-9399
Lighthouse Book Store (305) 781-1945
Sunnys At Sunset, Inc. (305) 471-2070
Computerland (813) 971-1680
Computerland (813) 392-0776
Computerland (813) 785-5579
Extra Extra Newstand (813) 886-1802
Henry's News Stand (813) 536-3863
Micro Computer System Inc. (813) 879-4301
Polling Place (813) 541-2729
Computerland (904) 224-5341
Computerland (904) 731-2471
Computer Shack (904) 396-1800
Computer Store/Gulf Breeze (904) 932-0660
Computer Sys. Resource (904) 376-4276
Florida Book Store (904) 376-6066
Goerings Book Ctr. (904) 378-0368
Grice Electrs. Inc. (904) 477-8100
Williams Radio and TV (904) 354-5460

GEORGIA
Atlanta Computer Mart (404) 455-0647
Baileys Computer Shop (404) 790-5771
Competitive Edge, Inc. (404) 487-6460
Computerland/Atlanta (404) 953-0406
Guild News Agency (404) 252-4166
Micro-Graphics Systems, Inc. (404) 790-5771
Computer Gazebo (912) 232-8888
Electronics 21 Inc. (912) 352-0585

HAWAII
Amtec Inc. (808) 955-7429
Computer Center (808) 448-2171
Computerland/Hawaii (808) 521-8002
Data 1 Microcomputer (808) 946-1733
Radio Shack No. 7086 (808) 487-1509

IDAHO
Memory Bank (319) 386-3330
Computer Country, Inc. (319) 377-9437
Computerland of Cedar Falls (319) 277-1700
The Partstore, Mario Iowa (319) 373-1803

ILLINOIS
Byte Shop (217) 352-2323
Computerland/Champaign (217) 359-0895
Computer-Ease (309) 833-3886
Wallace Micro-Mart Inc. (309) 685-7876
ABC Byte Shop (312) 673-3550
Book Market (312) 944-3358
Book Market (312) 440-4475
Byte Shop (312) 579-0920
Complete Computing (312) 620-0808
Compusup (312) 593-1800
Computerland (312) 949-1300
Computerland (312) 967-1714
Computerland (312) 422-8080
Computerland/Naperville (312) 369-3511
Computerland/Northbrook (312) 272-4703
Computerland/Schaumburg (312) 253-3009
Data Domain/Schaumburg (312) 397-8700
Digitalworld (312) 628-8222
Erickson Communication (312) 615-1511
Illinois Microcomputer (312) 420-8813
Kroch's & Brentano's (312) 332-7500
Micro Computer Ctr./Geneva (312) 232-1545
Nabih's Inc. (312) 489-8190
Northbrook Computers (312) 941-8005
Oak Brook Computer Ctr. (312) 529-9060
Page One (312) 384-5350
Prairie News Agency (312) 255-8040
The Book Store (312) 861-1255
Videomart Inc. (312) 420-8813
Wine Micro Computers (312) 336-3321
Univ. Bookstore (312) 229-0200
Alpine Computer Ctr. (815) 758-8666
Appletree Computer (815) 741-3303
Computerland/Joliet (815) 962-7580
Computer Store/Rockford (815) 962-7580

INDIANA
Acro Electronics (219) 397-8681
Bytrex (219) 485-7511
Computerland (219) 256-5688
Computerland (219) 483-8107
Computerland (219) 769-8120
Computer Plus (219) 683-9850
Computer Room (219) 277-1515
Data Base (219) 484-3164
Computerland/Anderson (317) 649-1122
Computer Store (317) 662-9994
Graham Electrs. (317) 634-8202
Heathkit Electr. Ctrs. (317) 257-4321
Hoosier Electrs. (812) 232-8508

KANSAS
Amateur Radio Equip. (316) 264-9166
Computerland Hutchinson (316) 662-6832
Computerland (316) 684-3870
High Technology/Wichita (316) 262-0315
Goshute Inc. (316) 265-8858
Book Nook (913) no listing
Computerland (913) 492-8882
Computerland/Topeka (913) 267-6530
Computerland (913) 841-8611
Omnilcon Computer Centers (913) 441-6651
Personal Computer Ctr. (913) 649-5942
The Computer Room/Beatty (913) 341-3500

KENTUCKY
Computer Emporium (502) 589-9482
Heathkit Electr. (502) 245-7811
Computer Place (606) 276-3594

LOUISIANA
Computer Shoppe Inc. (504) 454-6600

MAINE
Retail Computer Ctr. (207) 669-6736

MARYLAND
Bethesda Computers (301) 657-1992
Chaffitz (301) 340-3300
Computer Crossroads (301) 730-5513
Computers Etc. (301) 268-5801
Computers Etc. (301) 268-5801
Computers Etc. (301) 296-0520
Computerland (301) 440-8484
Computerland/Towson (301) 337-5555
Computer Unlimited (301) 321-1553
Fredericks Computer Products (301) 694-8884
Heathkit Electrs. (301) 881-5420
Komar Ltd. (301) 675-2290
Logical Choice (301) 465-3175
Micro Age (301) 762-7585
Basik Computer (301) 840-0412
Program Store/Baltimore (301) 944-0200
Radio Shack (301) 224-2900
The Comm. Center (301) 792-0600
Wills Computer Store (301) 423-4525

MASSACHUSETTS
Computer Source (413) 443-7181
Retail Computer Ctr. (413) 589-0106
Small Computer Data Sys. (413) 592-6600
Computer City (617) 552-4454
Computer City (617) 878-3128
Computer City (617) 273-3146
Computer City (617) 242-3350
Computer City (617) 826-9217
Computer City (617) 774-7118
Computerland/Boston (617) 235-6652
Computerland/Boston (617) 482-6033
Computer Store (617) 232-5470
Computer Store (617) 354-4599
Harvest Computer (617) 547-3289
Heathkit Electrs. (617) 237-1510
Land of Electronics (617) 581-3133
New England Electronics CO (617) 449-1765
Ni-Ni's Corner, Inc. (617) 547-3558
Out of Town News (617) 354-7777
Palace Spa (617) 783-5858
Retail Computer Ctr. (617) 935-8060
Small Business Group (617) 692-3800
YDI Elect. (617) 933-1446
YDI Elect. (617) 449-1005

MICHIGAN
Binary Corp (313) 548-0533
Community News Center (313) 662-6150
Computer Center (313) 422-2570
Computer Connection (313) 447-4470
Computer Horizons (313) 464-6502
Computerland (313) 772-6540
Computerland/Southfield (313) 356-8111

Computer Mart	(313) 649-0910	Computerland/Little Neck	(516) 887-4747	TEXAS	
Computer Mart/Flint	(313) 234-0161	Computerland/Nassau County	(516) 742-2262	Computerland	(214) 363-2223
The Family Computer Center	(313) 546-8114	Computer Concepts	(516) 374-0255	Computerland/Tyler	(214) 581-7000
Front Page Bookstore	(313) 332-3431	Computer Headquarters	(516) 698-8836	Computer Video Sys.	(214) 423-3654
Heathkit Electr.	(313) 772-0416	Computer Microsystems	(516) 627-3640	Heathkit Electrs. Ctr.	(214) 826-4053
Heathkit Electr. Ctr.	(313) 535-6480	Computer Shoppe	(516) 758-6558	Percom	(214) 272-3421
Metro News #2	(313) 851-7121	Data Scan Comp. Sys.	(516) 698-6285	Micro Store	(214) 231-1096
New Horizons Book Shop	(313) 296-1560	Future Visions Computer	(516) 423-7820	Simtec	(214) 484-3319
Rainbow Computers	(313) 528-3530	Harrison Radio	(516) 293-7990	Software Concepts	(214) 458-0330
Rochester Book Center	(313) 651-0199	Heathkit Electrs.	(516) 334-8181	Softwares	(214) 644-5043
Simtec	(313) 855-3990	L.I. Computer Store	(516) 887-1500	BAPS	(512) 657-7034
Spectrum Computers	(313) 559-5252	Programs Unlimited	(516) 997-8668	Computerland	(512) 724-1551
Community News	(517) 321-8797	Spartan Electrs.	(516) 499-9500	Computerland/Austin	(512) 452-5701
Community Newscenter	(517) 694-0490	Syosset Video & Electrs.	(516) 921-5454	Computerland of Austin II	(512) 327-7044
Community Newscenter	(517) 349-3510	Castle Computers	(516) 783-9405	Computer 'N' Things	(512) 453-5970
Computerland/Grand Rapids	(616) 942-2931	Computer Room	(518) 869-3818	Computer Shop	(512) 828-0553
Computer Mart/Lansing	(517) 351-1777	Future Distribution	(518) 561-5703	Computer Solutions	(512) 341-8851
Computers & More	(616) 243-3525	Computerland/Ithaca	(607) 277-4888	Computer To-Go	(512) 472-8926
NCE/Compumart	(617) 491-2700	Computer Tree	(607) 748-1223	Douglas Electronics	(512) 883-5103
MINNESOTA		Computerland	(716) 586-0378	Expensive Toys/Big Boys	(512) 340-5600
Compudata	(218) 722-6319	Computer Resource	(716) 836-6511	Heathkit	(512) 341-8876
Granada News	(218) 727-9122	Computer Store-Rochester	(716) 633-9510	Micro Age Computer Store	(602) 894-9247
Readmore Book & Card	(507) 345-5704	Home Computer Ctr.	(716) 244-5000	City Electr. Supply	(713) 621-1060
ABS Computer	(612) 253-8734	Modern Tek Shop, Inc.	(716) 244-6237	Computer Center/Houston	(713) 527-0080
Computer Depot	(612) 375-2008	Micro Age Computer Store	(716) 839-5800	Computercraft	(713) 977-0664
Computerland	(612) 559-1984	Readout Computers	(716) 244-9000	Computerland/Houston Bay	(713) 488-8153
Computer Professionals	(612) 435-8060	Computer Corner	(716) 634-9354	Computerland/Westwood	(713) 270-1200
Digital Den	(612) 699-8442	Computer Store	(914) 949-3282	Computer Technique	(713) 947-9633
Heathkit Ctr.	(612) 938-6371	Heathkit	(914) 428-1661	Lone Star News	(713) 981-0288
Micro Age Computer Store	(612) 338-1777	Mr. Computer	(914) 761-7690	Micro Age Computer Store	(713) 270-9647
Minnesota Book Center	(612) 373-5734	Mr. Oz News Center Book Store	(914) 297-1223	Micro Age Computer Store	(713) 440-7547
Personal Business Systems	(612) 929-4120	Programs Unlimited	(914) 638-0990	Northwest Newstand	(713) 681-7310
Readmore Bookstore	(612) 333-3628	NORTH CAROLINA	(914) 761-9283	The Computer Store	(713) 448-7766
Schindler's Hennepin News	(612) 333-6942	Byte Shop	(704) 568-8100	The Right Stuff	(512) 346-1321
Shinder Book & News	(612) 227-0899	Computer Alternatives	(704) 274-5404	Waghalter Books	(713) 627-9970
MISSOURI		Computercom	(704) 377-9821	Westheimer Newstand	(713) 781-7793
Computer Center	(314) 444-3111	K & S Newstand	(919) 724-1537	Young Electrs.	(713) 693-8080
Computer Country-North	(314) 241-5469	Liberty News & Beverage	(919) 493-1180	Agriplex Computers	(806) 797-4495
Famous-Barr Computer Ctr.	(314) 427-6116	Worldwide News & Specialties	(919) 467-7130	Computer Port	(817) 469-1502
Gateway Electrs.	(314) 567-7644	NORTH DAKOTA		Computer Pro	(817) 654-3360
Micro-Age Computer Ctr.	(314) 567-3291	Computerland/Fargo	(701) 237-3089	Heathkit	(817) 737-8822
Computer Mart/Springfield	(417) 862-6500	Computerland/Grand Forks	(701) 746-0491	Software & Peripherals Ltd.	(817) 566-3888
House of Computers	(417) 782-0880	All Media Material	(216) 678-5499	Waco Comm.	(817) 772-8550
Computerland	(601) 362-8755	American Bookstore, New Parma	(216) 888-8210	Computer Tech Assoc.	(915) 533-2108
Southeastern Aud. Vis.	(601) 324-0797	Basic Computer Shop	(216) 867-0808	UTAH	
Computerland/Independence	(816) 461-6502	Cleveland Computer Co.	(216) 946-1722	Central Utah Electrs.	(801) 373-7522
Computerland	(816) 436-3737	Computerland/Akron-Canton	(216) 493-7786	Computerland	(801) 224-2608
Computerland	(816) 364-4498	Computerland/Warren	(216) 544-4191	Computerland/Salt Lake	(801) 364-4416
MONTANA		The Corner Store	(216) 722-2777	Quality Technology	(801) 521-5040
Computerland Billings	(406) 259-0565	Cosmic Comics	(216) 784-3449	VIRGINIA	
Consolidated Services	(406) 721-1811	Hudson Computer	(216) 653-9010	Computer Store	(617) 272-0294
Prairie Computers	(406) 727-6992	News Depot	(216) 454-4444	Arlington Electric Wholesale	(703) 524-2412
NEBRASKA		Abacus II	(216) 235-9321	Computerland	(703) 495-1415
Computerland/Lincoln	(402) 391-6716	Computer Connection	(419) 865-1009	Computerland/Tyson's Corner	(703) 893-0424
Computerland/Omaha	(402) 391-6716	Leo's Book & Wine Shop	(419) 222-6464	Computer Place	(703) 982-3661
Electronic Center	(402) 476-7331	The Open Book	(419) 255-5506	Computers Plus	(703) 971-1996
Micro Age Computer Store	(402) 564-7213	Future Now	(419) 423-1283	H.B. Computer Ctr.	(703) 295-1975
NEVADA		Micro Computer Ctr.	(513) 791-1700	Heathkit Electrs.	(703) 765-5515
Century 23	(702) 870-1534	News - Readers	(513) 879-4444	Home Computer Ctr.	(703) 595-1955
Computerland	(702) 369-2001	Wilkie News	(513) 223-2541	Program Store	(703) 536-5404
Home Computers	(702) 736-6363	Micro Age Computer Store	(614) 868-1550	Virginia Micro Sys.	(703) 491-6502
PCS Computer Service	(702) 870-4138	Micro Center	(614) 486-5381	V.F.I. Facilities	(703) 961-5991
NEW HAMPSHIRE		Book Shack	(405) 233-1588	Computerland/Richmond	(804) 741-3536
All Software	(603) 883-7000	Computerland/Oklahoma	(405) 755-5200	Home Computer Ctr.	(804) 282-1817
Bitznoyes	(603) 643-5413	Computer Service Unlimited	(405) 329-2154	WASHINGTON	
Chips Microcenter	(603) 898-2390	Computer Works	(405) 624-5276	A B C Comm.	(206) 364-8300
Computer City	(603) 668-9527	Employee's Assoc. Bookstore	(405) 686-4295	Almac-Stroum	(206) 643-9922
Computerland/Nashua	(603) 889-5238	High Technology Detail	(405) 528-8008	Amateur Radio Supply Co.	(206) 767-3292
Computer Mart/New Hampshire	(603) 883-2386	Micro Age Computer	(405) 728-1837	Byte Shop	(206) 622-7196
Computer Town	(603) 893-8812	Computerland/Tulsa	(918) 481-0332	Central Computers	(206) 746-5227
NEW JERSEY		Computer Store	(918) 224-5347	City News	(206) 455-9683
Apple Cor.	(201) 766-3977	OREGON		Computerland	(206) 581-0368
Computer Corner/New Jersey	(201) 835-7080	Byte Shop	(503) 644-2686	Computer & Video Ctr.	(206) 485-1540
Computer Dimensions	(201) 232-8300	Computerland/Portland	(503) 620-6170	Date-Borne Computers	(206) 248-0101
Computer Forum	(201) 530-9103	Computer Solutions	(503) 689-9677	Empire Electrs.	(206) 244-5200
Computerland	(201) 845-9300	Computer Specialties	(503) 399-0534	Heathkit	(206) 682-2172
Computerland/Morristown	(201) 539-4077	Computer Store Corvallis	(503) 754-0811	Heathkit	(206) 246-5357
Computer Mart/New Jersey	(201) 283-0600	C 2 Avenue News	(503) 245-9785	Mentor Personal Comp.	(206) 527-0909
Computer Nook	(201) 575-9468	Micro Age Computer Store	(503) 222-7462	Western Micro Computer Ctr.	(206) 676-9558
Computer Technicians	(201) 238-2780	New Day Computing	(503) 256-4713	Alpha Computer Sys.	(509) 586-7603
Computer Universe	(201) 282-0960	Norvac Electrs.	(503) 223-8033	Personal Computers	(509) 534-3955
Comtek	(201) 472-2440	Rich Cigar Store	(503) 644-1025	Rob Roy Computer Shop	(509) 575-7704
Earth Rise Micro Sys.	(201) 822-0518	PENNSYLVANIA		WISCONSIN	
Heathkit Electr. Ctr.	(201) 791-6935	A B Computers	(215) 822-7727	Asmus Electronics	(414) 923-4107
Radio Shack	(201) 244-7494	Computer Forum	(215) 296-3474	Byte Shop/Milwaukee	(414) 281-7004
Software City	(201) 342-8788	Computerland/Dresler	(215) 542-8835	Chester Electr. Supply	(414) 658-4616
Stoneledge Computer	(201) 277-1023	Computerland/Lehigh Valley	(215) 776-0202	Computers Unlimited	(414) 355-5206
The Computer Center, Inc.	(201) 391-1006	Computerland/Paoli	(215) 296-0210	Computerworld	(414) 733-9547
Bargain Brothers	(609) 883-2050	The Computer Source	(215) 375-4231	Digital Den	(414) 475-6020
Clancy Paul	(609) 683-0060	Orexel University Book Store	(215) 895-2000	Four J's	(414) 466-8990
Computer Encounter	(609) 924-8757	Heathkit Electr. Ctr.	(215) 288-0180	Prospect News	(414) 278-6110
Computerland/Cherry Hill	(609) 785-5900	Heathkit Electr. Ctr.	(215) 647-5555	American Computer Sys.	(608) 257-1348
Computer Workshop	(609) 865-4404	Marketline Sys.	(215) 947-6670	Computerland/LaCrosse	(608) 781-2090
Personal Computing	(609) 927-3880	Mighty Byte Computer Ctr.	(215) 443-9020	Computerland/Madison	(608) 273-2020
Radio Shack	(609) 234-2666	Computer House	(412) 921-1333	Computerland/Eau Claire	(715) 835-8082
The Computer Port	(609) 641-4300	Computer Workshoppe	(412) 823-6722	WEST VIRGINIA	
NEW MEXICO		Erie Computer Co.	(412) 454-7652	Computerland	(304) 744-7962
Computerland/Santa Fe	(505) 988-8800	Pittsburgh Computer Store	(412) 391-8050	Computerland/Parkersburg	(304) 485-6823
Computer Shop	(505) 762-3327	Computer Store	(717) 272-0294	Computer Store	(304) 345-1360
Electronic Parts Co.	(505) 293-6161	Computerland/Harrisburg	(814) 533-6892	Nicks News	(304) 697-2459
Micro Waves Computer Store	(505) 883-0955	RHODE ISLAND		WYOMING	
Computer Tech Assoc.	(915) 533-2108	Computerland	(401) 274-5100	Computerland	(307) 634-9552
NEW YORK		Computer City	(401) 331-2187	Computerland/Casper	(307) 234-2879
Computer Center	(212) 889-8130	Computer Power	(401) 738-4477	CANADA	
Computer Discount Services	(212) 757-8698	Computer Store	(401) 272-8770	Galtica Computers	(403) 424-7007
Computer Era	(212) 860-0500	SOUTH CAROLINA		Micro Dist.	(416) 361-0809
Computerland	(212) 840-3223	Datamart/S. Carolina	(803) 233-5753	Lichtman's News	(416) 961-1466
Computerland of Little Neck	(212) 423-5280	Gismo Comm.	(803) 366-7157	Computer Circuit	(510) 672-9370
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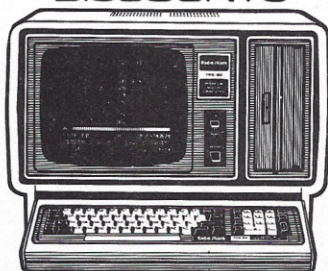
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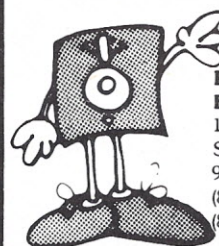
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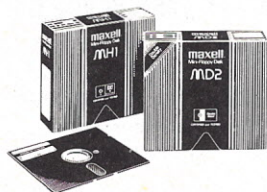
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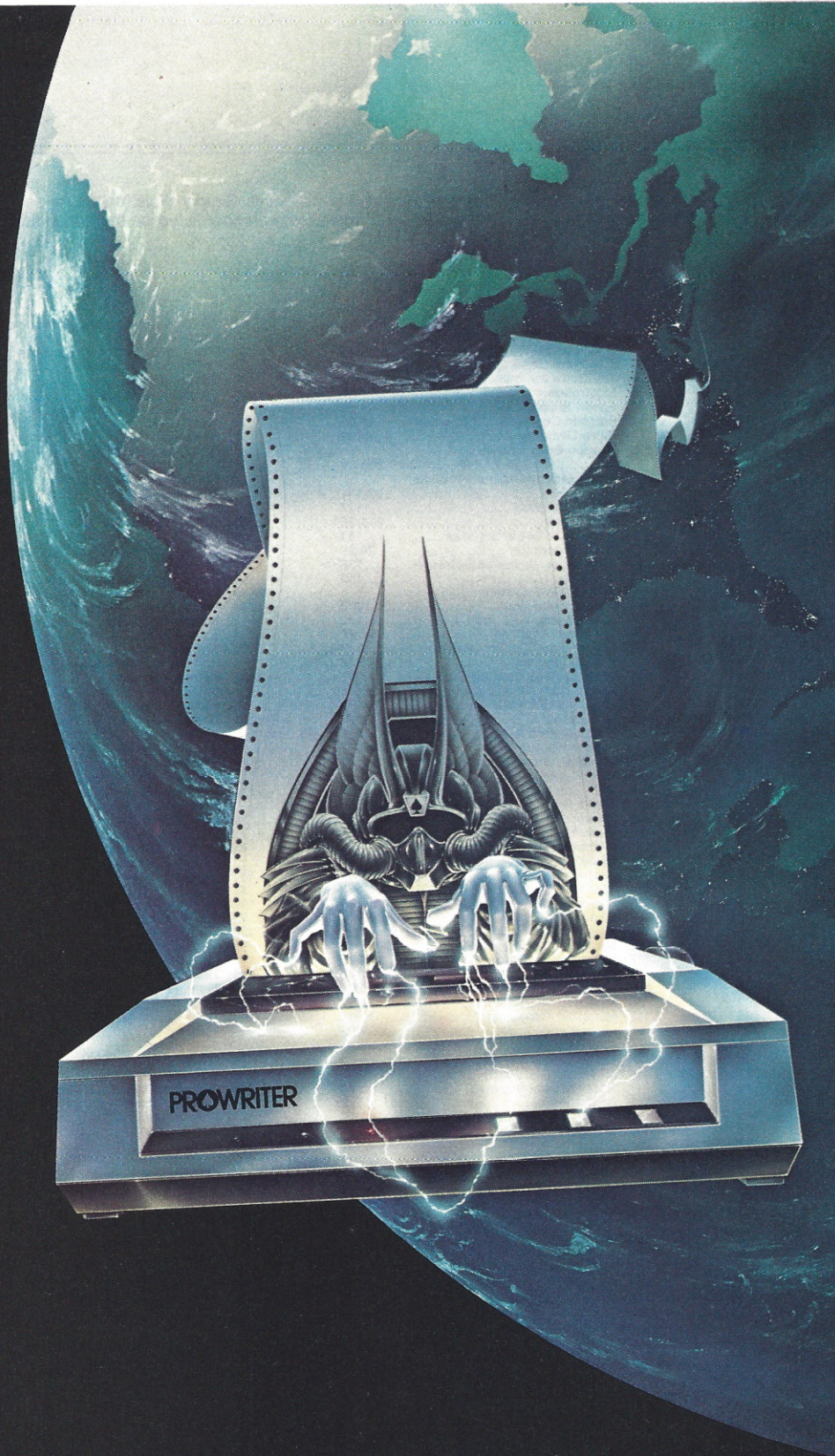
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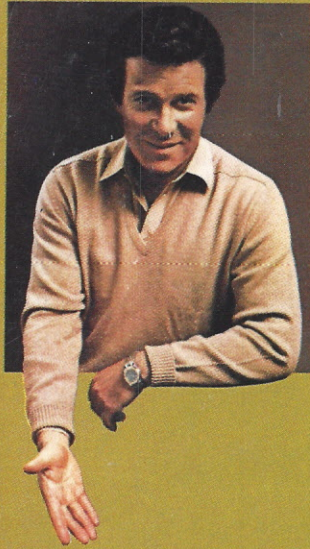
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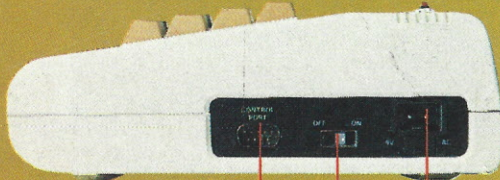


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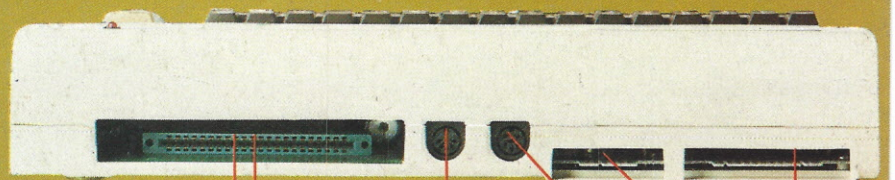
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Price*	\$299.95	\$399.00	\$454.00	\$399.00
Maximum RAM Memory	32K	16K	48K	32K
Keyboard Style	Full-Size Typewriter Style	Flat Plastic Membrane	Full-Size Typewriter Style	Calculator Style
Number of Keys	66	57	48	53
Programmable Function Keys	4	0	0	0
Graphic Symbols On Keyboard	62	0	0	0
Displayable Characters	512	256	192	256
Microprocessor	6502	6502	TMS9900	6809
Accessible Machine Language	YES	YES	YES	YES
Upper/Lower Case Characters	YES	YES	YES	NO
Operates with all Peripherals (Disk, Printer and Modem)	YES	NO	YES	YES
Full Screen Editor	YES	YES	YES	NO
Microsoft Basic	Standard	N/A	N/A	\$ 99.00
Telephone Modem	\$110.00	\$399.95	\$450.00	\$154.95

*Manufacturer's suggested retail price Mar. 1, 1982



Read the chart and see why COMPUTE! Magazine¹ calls the VIC-20 computer "an astounding machine for the price." Why BYTE² raves: "...the VIC-20 computer unit is unexcelled as a low-cost consumer computer." Why Popular Mechanics³ says "...for the price of around \$300, it's the only game in town that is more than just a game." And why ON COMPUTING INC.⁴ exclaims: "What is inside is an electronic marvel... if it sounds as if I'm in love with my new possession, I am."

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1 April '81 issue 2 May '81 issue 3 November '81 issue 4 Fall '81 issue



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